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A descriptive method for child language disability : the formal semantics, logic, and syntax of small languages.

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A DESCRIPTIVE METHOD FOR CHILD LANGUAGE DISABILITY:

The Formal Semantics, Logic, and Syntax of Small Languages

A Dissertation Presented

By

Stan Kulikowski II

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School of Education

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This is dedicated to

my brother

Kory

whose meaning is more
than he can say

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Preface

What does all this have to do with education? I encounter this question quite often, and I consider it to be challenging as I am indeed seeking a degree in education and take some pride in being a teacher's teacher-- the next step above master teacher. There is considerable doubt that I ever answer this question well, but I try the task often enough to have rehearsed a number of approaches. The delights of the mind are hard to satisfy but easy to nourish, so, if I manage to intrigue a few into the love of technical detail, I will be content because tremendous accomplishments can come from a few good people.

Education is an undisciplined profession. There is no set of principles to which every teacher can agree which in any way constrain practice. I take it to be self evident that organizations of teachers usually produce statements that are so general that any set of teaching practices can be accepted in the curriculum. Indeed, affective educators seem to delight in the fact that it is possible to teach without any content at all since students always bring some knowledge with them. The attempt to define a curriculum in behavioral objectives failed because performance is not knowledge, and competency testing has an equally dim future since what is learned does not have a direct relationship to what is taught. Without the principles of a discipline, it is not possible to evaluate teaching or to compare two teachers or to specify what is to be taught. By educational evaluation we usually mean a sampling of what has been learned by the student with very rare

measurement on the teaching itself. By curriculum planning we usually mean a listing of whatever subjects we feel like teaching or think necessary with very rare interest in metacurricular criteria-- that is, criteria which allow the selection of the better curriculum from alternatives.

To be a little less extreme, certain subject areas like mathematics and the sciences seem better at specifying a consistent body of knowledge in a curriculum such that some information is necessary before other information can be learned. In these areas the structure of the whole seems related to the composition of each of its parts. It is comforting for me, at least, to watch these integrated areas of curriculum grow as if alive, improving with each generation of students becoming teachers. It is no idle coincidence that many of the best teachers in a university have been so active with their subject material that they have never felt the need for a course in instructional method or have been unimpressed by their introduction to education as a formal study.

In spite of what I've just said, I believe there is good reason why education itself as an object of study should be among the last to come under systematic formal control. Psychology has yet to develop a central paradigm comparable to those in physics, chemistry, or molecular biology; and yet, education will need a psychological description of how the mind acquires knowledge before it can specify principles of curriculum which uniformly apply from calculus to dadaism. A theory

of the mind which is sufficiently complete to relate knowledge to learning in an empirically testable manner seems to be a prerequisite to at least part of the problem of educational discipline. Language has been considered as the primary mental ability, and I have sought the best formal treatment of language as a good place to begin improvements in educational theory and practice. At the least, I expect early childhood education and the special education of the disabled to bring accomplishments to the field of teaching which will help to reach the general goals of education.

I know I cannot explain to everyone the value I see in what I do. I can be satisfied if a few will grasp it and help me explain it and perhaps push the formal description of human ability a little further. To those in the teaching profession who do not see the need for formal discipline, I doubt there is anything I can say that will convince them. Without disciplined constraint on practice there is nothing we can do to effect each other. Talented teachers who recognize the art of escorting a learning mind should not fear formalism and the approach of those bearing machines with them: art in practice survives effective improvement. No one lightly dismisses the art of doctoring since science increased the standard of effective practice, and education should fare at least as well since it perhaps involves a larger population. In the long run, the fine arts may prove to be the last refuge for those who abhor technicalities of the sciences-- formalism might never have a motive for reaching into these fields of human endeavor.

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ABSTRACT

A Descriptive Method for Child Language Disability:
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This is a case study of the language abilities of five people. They each present a different problem for methods of analytic description and grammar construction. The major goal is to present a formal treatment of language disability, but some formal improvements in early child language are necessary along the way. The basic data are complete verbatim transcripts in most of the case studies. Four transcript samples of a young girl, aged 23 months, are presented to study the developments over a month of early syntactical phrase structures. The stable abilities of four adolescents are studied: one to illustrate details of transcriptional method; another to represent a language delay; another for a simple disorder; and the last may be a complex disorder or perhaps a language deviation.

The formalization of early child language and disabilities given herein primarily concerns the relationship between syntax and semantics. The lack of formal pragmatics is noted, although a few involvements with intensional logic and specified set-theoretical models are suggested.

The grammatical analysis is defined upon an arbitrary artificial language, and two fragmentary samples from published literature also are given to illustrate the earlier formal treatments with pivot grammar and also transformational phrase structure.

Like these earlier formal treatments, this study attempts to place empirical data within a systematic theoretical structure. In the manner of scientific advancements, this descriptive method accounts for all of the data which were the basis for the earlier formal treatments; provides a principled description for previous systematic counterexamples; and introduces new phenomena which were unobserved or even denied before this research. The integration between context-free phrase structure and model-theoretical semantics in generative grammar is found to be well-principled on the grounds of application to early child language and disability.

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0.0 Introduction

There is some hope that a complete formal specification of the human mind shall be available in the not too distant future. In the meanwhile, this study is an attempt to advance toward such a goal. The ordinary complexity of adult language presently escapes complete grammatical description, but child language and disability may be found to be sufficiently simpler in some aspects and so lead the way in discovering the integration of mental components. It may certainly be said that the use of syntax and semantics by a young child is simpler and increases in complexity in a knowable manner. It may less well be known that some handicapped people of any age also present simpler minds in communication and probably in mental competence. The purpose of this study is to demonstrate the relationship between a form of data which can be collected directly from a person in a relatively straightforward manner and a well-principled form of description.

The study of child language may play a role in formal psychology because the study of the child requires descriptive methods which demonstrate progress through a longitudinal series of data. If this system of description can be successfully applied to language disabilities it seems possible to develop formal treatments for such matters as learnability controls on educational curricula, evaluation of theraputic claims in the mental domain, possibly some modest advancements in artificial intelligences, and even the beginnings of an embryo field

of mental prosthesis. Even if these matters prove to be naught but pipe dreams and speculation, at least the results of this work should present linguistic descriptions of child abilities which are nearer the goal of formal specification than current psychometric or behavioral practices.

0.1 The method of this study involves the qualitative comparison of grammars to discrete and rather uncontroversial empirical data collected from selected individuals in the manner of a clinical case study. A simple orthographic transcription will suffice for the analysis of most every syntactical and semantical phenomenon. One may quibble over a particular analytic result or dismiss an empirical datum in the process of this study, but the explicit degree of description and the precise nature of the theoretical claims should remain recognizeable. It is no simple matter to present these procedures in mathematical formulations which are independent of any particular sample or language.

A series of individual language samples shall be analyzed to illustrate the principles of grammar construction and comparative evaluation. A chronological sequence of language samples is given to represent child development at the emergence of productive syntactical construction and how the grammatical description of data increases in synchronic complexity. A few samples of disabled people illustrate comparable descriptions for language disabilities.

The components of a generative grammar are taken to be the phonological, the lexical, the syntactical, the semantical, and the pragmatical. All generative grammars are constructed of a minimal set of recursive rules which interact in specified operations to derive the sets of observable sentences. Each component has its own domain of

phenomena within the overall integrated performance system. Each component may be characterized by its own data, its own form of rules, and its own relationship to other components. Contemporary linguistic theories differ according to these characteristics. The focus of this study is the relationship between syntax and semantics in the description of language abilities and will hence assume a certain degree of empirical dispensation towards other aspects of grammar. In the usual manner of generative grammar, a language is defined as a set of sentences, possibly infinite, which has a common source which is presumably systematic.

0.2 The phonological component of a generative grammar is a system of rules which govern the patterns of speech sounds of a language. This is usually the least controversial component of a grammar; although, the role of prosody, morphology, and other sound-related concerns are somewhat more disputable, Since the last century there have been phonetic alphabets for the almost universal description of human speech sounds in a manner that tries to be independent of any particular language. Phonological rules have been developed to operate upon subphonemic features and to structure them into the sound patterns of English (Chomsky and Halle 1968). Phonological analysis is a well established cornerstone of speech pathology and there are many reasonable considerations of phonological disabilities in children (Ingram 1976). With this, it shall be assumed that phonology is a sufficiently independent component of grammar which assigns a phonetic description to any sentence of a natural language.

This method of considering grammatical components independently is a matter of theoretical delineation and is not intended to raise overt problems in psychological reality or clinical application. Independence from phonological issues is accepted merely to simplify the form of data and transcription in the syntactical-semantical analysis whose interaction is to be considered in some detail. Bresnan (1975) illustrates some of the empirical problems in a syntax-independent phonology and none of these problems seem resolvable by purely phonological means. The simplification of the componential data to just the syntactical and semantical information should not be taken as suggesting solutions to general problems of the total grammar.

0.3 The syntactical component of a generative grammar is a system of rules which govern the linear sequence of words and affixes in the sentences of the language. Structural relationships between these words and affixes are related to the composition of propositional interpretations governed by the semantical component. The syntax of a grammar contains rules which assign at least completely unambiguous structural description to any grammatical sentence. For this, two syntactical subcomponents are constructed in the manner of Chomsky standard theory (Chomsky 1965; Katz and Postal 1964): the phrase structure rules and the transformational rules. The phrase structure rules operate upon the lexical items, building them up into more complex structural units. For each sentence, the phrase structure rules derive at least one initial phrase marker which can be interpreted unambiguously. The transformational apparatus operates upon initial phrase markers-- or deep structures-- to derive final phrase markers-- or surface structures-- in a

manner which preserves the initial meanings. These standard transformations have not proven very useful in early child language, but they are given herein for historical perspective to earlier studies.

0.4 The semantical component of a generative grammar is a system of rules which govern the propositional interpretations which may be assigned to the sentences of the language. A proposition is taken to be that which remains constant in exact paraphrase or in exact translation. Propositions are formalized in a truth-conditional predicate calculus in the manner of Montague (1974). For each phrase structure rule in syntax there is a corresponding semantical rule which states how the meanings of the more complex structure is composed from the meanings of the constituents. This rule-by-rule correspondence between the syntactical phrase structure and the composition of semantical propositions does produce some dependence between these two components of grammar. The kinds of phrase constructions which analysis will propose for some datum can be evaluated with respect to the semantical propositions also found in that datum.

Besides the propositional meanings of the predicate calculus, the semantical component assigns a model-theoretical interpretation to each expression. The model interpretation is usually constructed as ordered sets whose domain of primitives is arranged in possible ordered pairs.

0.5 The lexical component of a generative grammar is a categorized system of words and affixes of the language. These words and affixes serve as both the terminal elements of syntax and the basic expressions of the semantics. Consequently, the categories of the lexicon are sets

organized by their syntactical form and semantical function. In the grammars to be used in this study, the lexical categories are identified by the combinatorial properties of its contents and by the relationship of its contents to certain semantical primitives. The lexical items enter the syntactical and semantical operations as unanalyzed constants. The sentential operations are so constructed that sublexical definitions with additional information are not available to the formulation of its derivational form or compositional function.

It may seem strange that the semantical component does not have access to complete definitions of contentive words. It is the purpose of the semantical rules to characterize propositional formulae with the kinds of logical inference which people are known to make upon sentence structure. There are certainly other kinds of inference than those based upon the formal analyticity of sentence form: implication in conversational discourse (Grice 1975), deictic elements of nonlinguistic contexts (Brunner 1975), sublexical information (Katz and Fodor 1963). The explication of all these inferential systems will lie beyond the capacities of a sentence grammar. The sentence is taken to be a natural unit of language, and the lexical items are given as its basic elements.

0.6 The pragmatical component of a generative grammar is considerably less well characterized, and no formal treatment shall be advanced here. There is some confusion in child language literature about the role of pragmatics and its relationship to the semantical component, but it will probably be some time before complete agreement is reached in the complete specification of the pragmatical rules. The transcript data will be presented with enough situational information to be of some

analytic value when formal treatments become available, but lacking these now, it is difficult to speculate on what features of discourse and situation should be systematically preserved. Some rough suggestion on the pragmatical interaction with intensional logic and model theory may be found in the discussion of the semantical analyses.

1.0 Transcription

The conventions of orthographic transcription are of two sorts: the clinical conventions and the intuitional conventions. The former are necessary for clinical purposes to connect the data to a particular client while the latter are necessary to assure the accuracy of the transcription to the particular performances of the client. The clinic conventions will not be of much concern here as they involve ethical and working problems of professional treatment centers and their clientele. Among such specifications should be guidelines for the construction of a language corpus, the organization of its possible contents, standards of client confidentiality, clinically approved procedures, and so forth. These clinical conventions do not require much specifications in this study since most of the language samples are of a single variety. Unless otherwise stated, all data will be an actual spontaneous performance of an individual-- usually a client involved in some form of clinical program. It is required that the conversation be typical and familiar for that individual and can be transcribed with reasonable confidence of word order and inflectional form. Reasonable confidence shall mean that other speakers of English have read the transcript and listened to the conversation with equal satisifaction as to the accuracy. Tape recording

is the usual method of choice by which reasonable confidence is established.

The intuitional conventions are a set of notational devices used in transcription and are subject to satisfaction by speakers of English. Since phonological analyses are not considered, phonetic transcription will largely be unnecessary and a simple orthographic approach shall be assumed. In the transcription process, the clinician is certifying that a series of markers on paper do indeed represent a series of psychological units which the client uses in communication. In some cases, the claim may be made that these markers are identical with the set of English words and in these cases the intuitional satisfaction of an English competent reader would be high. In what follows, these intuitions are refined into mathematical definitions which can be compared more precisely to definitions of English or other particular languages. In other cases, the markers do not much resemble English words and unique transcriptional information will have to be provided to establish their relationships to client performances. It is expected that the intuitive satisfaction of the English competent person will become lower accordingly. As this study progresses, an attempt is made to increase this effect. The description of a language disability requires a very general system of data transcription which is increasingly less dependent upon a particular language.

1.1 The orthographic conventions of the study assume that a transcript represents language that has been understood well enough to carry on a connected conversation. At first this may seem tedious, but with

some disabled individuals this may require some phonological familiarity in order to understand what is being said. It is also sometimes rather difficult to say what a connected conversation is to a very young child or to extremely autistic ones. Similarly, the understanding of what an utterance is may be extended to include more than spoken performances: sign languages, communication boards, prosthetic spelling devices, rebus symbols, and the like. For the beginning, however, it shall be assumed that transcription requires familiarity with spoken English and a dictionary spelling for its words. The following pretheoretical symbols may be conventionalized:

1.11	ABCDEFGHIJKLM NOPQRSTUVWXYZ	The twenty-six characters of English alphabet,
1.12	#	the word boundary blank, and
1.13	-	a specialized blank for performance breaks.

The characters of the English alphabet are used merely for convenience as any system for marking the order and inflectional form of words may be substituted. Capital case lettering is used exclusively in order to avoid unnecessary capitalization conventions which are not distinguished in spoken performances. A word as a basic theoretical unit is separated from other words by word boundary blanks. Word boundary blanks are usually suppressed in actual transcriptions for ease of reading, but their use as an intuitional convention is assured. No abbreviations may be tolerated as the data concerns the sequence of words as spoken, and a transcript will contain nonstandard orthography only if there is a serious claim being made for a structural difference in that element from

the usual English equivalent. For example, the common phonological reduction DIDJA would be employed in place of DID YOU only if the former were considered to differ syntactically or semantically from the latter, and the DIDJA should be structured and interpreted as a single lexical item. The assignment of word boundaries in heavily contracted speech or poor articulation is very often difficult, but this should not prevent the task. Secure grammatical description may be based on conversation which was well understood by the transcriber.

1.14	#...#	A word is any series of one or more characters between consequetive word boundary blanks.
1.15	##...##	A sentence is any series of words and blanks which are understood to have a grammatically structured meaning.
1.16	##...--	A sentence broken off in performance.
1.17	#...-	A word broken off in performance.
1.18	#...-...#	A complex word has a series of words or syllables without the usual boundaries, forming a single lexical item.

With these basic conventions it is possible to construct a transcript of a conversation and thus represent what has been said. The arrangement of the pretheoretical symbols represent the exact order of the linguistic units that a client used in communication. This then is the nature of the transcribed data which records what has been said, and these intuitions of communication are the subject of theoretical refinement in the syntactical and semantical analyses.

It is now possible to introduce a sample transcript of basic data. As follows, 1.19 contains two chronologically ordered fragments of tape

recorded conversation, 3 May 1974. This young man, Doug, aged 11 yr 8 mo 15 da, is very carefully articulate so that there is no difficulty in establishing word order, inflectional form, and other word qualities. Doug's conversational abilities give a variety of transcriptional problems by which to introduce additional punctuational conventions. His syntactical and semantical abilities seem comparable to contemporaneous adults-- one of which is represented in this conversation. He seems to have complete sentence level abilities, but his conversations are not, however, usual for an 11-year old. In the discourse Doug seems to display some vague properties of disturbance which seem intuitively present to a reader familiar with the conversation of young adolescents. Since Doug's sentence level grammar seems adequate, the disturbance must concern conversation level qualities or other higher cognitive abilities. This method of simple transcription then seems capable of representing more information than that strictly needed for the study of syntax and semantics of children.

The shifting of letter case below is introduced merely to distinguish the contributions of both participants in the conversation, Doug retaining the capital case. Single word boundaries have been suppressed to aid the readability of the text.

1.19 a ##THE REASON WHY HE GOT--THE REASON WHY HE HAD A PLANE WRECK--BECAUSE--IT FELL APART##BECAUSE--THE REASON WHY HE HAD--THE REASON WHY HE HAD A PLANE WRECK##BECAUSE--well what happened##THE REASON WHY HE HAD A PLANE WRECK AND HE FELL THROUGH THE FIRE AND GOT BURNED UP BECAUSE HE--UH--AND DIED--BECAUSE THE PLANE WASNT--BECAUSE THE PLAN MUST HAVE BEEN AN OLD ONE##that would explain it wouldnt it##YEAH##

b ##what happens when you die##YOU GO TO HEAVEN##what do people do with you when youre dead##THEY SEND YOU TO JESUS##how do they do that##JESUS IS A PICTURE OF YOU AT HEAVEN##yes i know that but how do people send you there##THEY BURY YOU AT A CEMETARY##you ever seen all that##YEAH##

It should be clear that 1.19a is a cyclic monologue in which Doug is more or less rephrasing statements until he arrives at one which may be causal (ie-- having been an old one) rather than redefinitional of plane wreck (ie-- falling apart, falling through fire, getting burned up, and dying). The lexical substitution of PLAN for PLANE in the final causal statement is a recurring aspect of Doug's use of language, like the cyclic rephrasing. These may be more clearly observed with the introduction of punctuational conventions to further constrain intuitions concerning transcription.

1.2 Punctuational conventions may be added to note other intuition about the meaning or structure of the sequence of sentences which the transcriber might wish to enter without advancing any semantical or syntactical claims. The punctuation devices are usually accepted in order to aid in the readability of the text or the analytic processing without essentially altering the nature of the data.

1.21 Initial sentence boundaries are numbered consequetively and the contributions of each conversationalist may be columnized with column breaks being assigned preferentially to phrase boundaries, if present, or then to single word boundaries.

1.22	,	Intonational phrase boundary
1.23	?	Questioning contour
1.24	'	Compositional word structure

1.25	"..."	Direct quotation
1.26	(...)	Contextual information
1.27	/.../	Uninterpretable portion of data
1.28	--#	A performance stammer within sentence
1.29	XXX	Confidentiality shield

Punctuation is added to aid in the readability of transcripts, especially the large ones collected for clinical language studies. The organizational convention 1.21 is adopted for reference purposes in locating specific portions of data. Commas and question marks are intonational phenomena which affect conversational progress independently of the sentence structure or meaning. There are certainly some syntactical or semantical operations which are associated with phrase structure and questioning, but these operations are identified within the lexical array of data by the analytical method. These punctuational devices for intonational marking are for convenience and for strong speech features which aid in understanding the conversational structure in progress.

Contraction is frequently thought to be a syntactical operation which alters word boundaries between certain structural categories. The apostrophy indicates where more than one lexical item is thought to be present even though there may be no obvious or subtle speech features to distinguish the understood structure. There is afterall nothing which distinguishes the occurrences of THEY'RE, THERE, or THEIR other than the transcriber's understanding of what was said. Heavily contracted or pathologically stereotyped or extremely imitative speech will challenge a transcriber's ability to assign word boundaries with certainty. In a

similar manner, direct quotation frequently is unaccompanied by any vocal qualities so that the understood shifts in interpretation are attributed to conversational features of discourse. A grammar of the sentences does not account for these devices although they aid in the processing of the data.

The slash notation 1.27 is used to indicate portions of the transcript where the transcriber is sufficiently unclear such that analytic claims should not be based upon any material contained within. Slashed segments may contain a series of hyphens to indicate complete failure of interpretation for that portion of the message. Slashes may also contain some phonetic representations of audible sounds which are presumably part of the linguistically coded sequence, but are of uncertain word value. Sometimes the slashes may contain portions of the usual English orthography when the transcriber is almost certain of the word sequence but entertains sufficient doubt or awareness of alternative wording so to excuse that portion of the data from serious analytical concern. The slash notation helps maintain transcript integrity during replay of tape recorded material, identifying which portions are relevant for analysis and which portions are excused on grounds of auditory inaccuracy.

The role of contextual information in sentence analysis has been a subject of interest in many studies of precompetent children (Bloom 1970; Greenfield and Smith 1976). This kind of study does not possess explicit semantical principles and so they attribute much to contextual situation which is properly semantical interpretation. Not much is to be made of this. The syntax of Bloom (1970) will be considered in detail in later

sections, and the semantical analysis offered below is based on what is understood in the word relationships rather than any systematic reliance upon pragmatical fields. Contextual reliance seemed necessary for these earlier studies since they lacked formal semantics and they set about to taxonomically classify meanings in a nongenerative manner. The results of these studies are rather loose collections of semantical categories which may be descriptive yet lack explanation.

For all that, contextual information is often necessary to understand some of the marginal conversation produced when one of the conversants lack syntactical or semantical abilities employed by the person doing the transcritpion. As a punctuational device, context is helpful in assuring that the relationships between the words have been properly understood, but the context should establish the interpretation only of certain explicit deictic variables, like pronouns or the definite article. From the very beginning of syntactical development a child may express many relationships in words which do not exist in any tangible sense. Reference to contextual information cannot crucially determine the semantical interpretation of the child's utterances. Conversely, small children and some disabled persons certainly do rely heavily upon a skilled conversant to interpret environmental situations for information about the sentences in the discourse. Necessary contextualization such as that needed for the reference of personal pronouns is not very different in principle from the pragmatical strategies to interpret the fragmentary language of small children.

Ideally, a complete grammar of communicative competence should contain a pragmatical component whose theoretical language would then

systematically account for necessary contextualization. There are many sources for pragmatical inference: perceptual searches, intonational contours, gestures, eye glances, and intuitions of conversational continuity which alter the implications of the discourse. Explicit sets of rules and principles underlying all such contextual phenomena cannot be precisely formulated in a manner comparable to syntax and semantics of current generative studies. Although the pragmatical information is frequently helpful, its status as a punctuational device is distinct from the formal consistency of syntax and semantics.

For the sake of brevity, other punctuational devices will be introduced within language samples as their use may be best illustrated where they occur. Further technical discussion may be deferred until then.

1.3 A language sample is introduced here from the same conversation as 1.19. These segments are selected to illustrate Doug's cyclic rephrasing and the use of punctuation in the transcription of such complex performances.

1.31

(1) ONCE-- ONCE BEFORE--
(2) DEAD PEOPLE DIE
(3) THEY GO TO A CEMETARY AND--
AND GO TO HEAVEN WITH JESUS
(4) IT'S /HAUS/ CHURCH
(5) PEOPLE THAT DIE--
(6) THEY-- UH--
(7) PEOPLE DIE
(8) PEOPLE ARE DEAD
(9) THEY GET BURIED IN A CEMETARY
(10) AND JESUS TAKES THEM TO HEAVEN

(1) i understand

(11) YEAH

The numberings and columnizations are for the convenience of processing large transcripts by scanning. Each conversant may be numbered

independently as above or sequentially, depending on the purpose of the transcript. Since numbering is conventionally assigned to sentence boundaries, the ## blanks may be suppressed to enhance readability without loss of information. The numberings between 1.31 (9-10) introduce an additional numbering convention for simple conjunction of otherwise grammatically complete sentences. 1.31 (3) is not numerically separated because the latter conjunct is understood in the meaning of a conjoined verb phrase rather than with a conjoined imperative which would have been numbered separately. This numbering of sentential conjuncts is needed because some conversational performances contain long series of conjoined sentences which are otherwise unrelated syntactically. The conversational numberings are sometimes marked with primes, as in 1.34 (10') and (2") forthcoming, to indicate that these utterances overlapped in the time of performance so that the later double-primed sentence may not be based upon knowledge of the earlier utterance. These features of discourse performance do not effect syntactical or semantical analyses, but make for nicer transcripts.

1.32

(1) SOME PEOPLE JUST GET UP--
(2) SOME PEOPLE JUST WRECK
(3) SOME PEOPLE JUST HAVE A--
(4) SOME PEOPLE--
(5) SOME PEOPLE JUST WRECK
(6) SOME PEOPLE JUST HAVE A PLANE WRECK
(7) AND THEY GET BURNED UP IN THE FIRE
(8) THEY--
(9) AND THEY GET BURNED UP IN THE FIRE
(10) AND THEY DIE
(11) THEY GO TO THE HOSPITAL

(1) then what happens?

(12) THEY GO TO HEAVEN

(2) in the hospital?

(13) THEY GET BURIED IN A CEMETARY
(14) AND JESUS TAKES THEM TO HEAVEN

(3) oh, okay

(15) AND JESUS TAKES CARE OF THEM AT HEAVEN
(16) THAT'S WHERE DEAD PEOPLE GO
(17) PEOPLE COULD DIE
IF THEY GOT HIT BY A CAR

1.33

(1) AND A PERS--
(2) AND A PERSON--
(3) AND A PERSON WHO GETS BURNT UP
BY A FURNACE--
(4) THEY COULD DIE TOO

(1) they could,
couldn't they?

(5) AND-- UH--
(6) PEOPLE'S HOUSES THAT BURNED DOWN--
(7) PEOPLE COULD DIE
IF THEIR HOUSES BURNT--
IF THEIR HOUSES BURNT DOWN

1.34

(1) IF PEOPLE GET BURNT UP IN A--
(2) IF PEOPLE GET BURNT UP--
(3) IF PEOPLE--
(4) IF PEOPLE GET BURNT UP IN A HOUSE--
(5) IF PEOPLE--
(6) YOU KNOW WHAT HAPPENS?
(7) YOU KNOW HOW--
(8) YOU KNOW WHAT HOUSES DO?
(9) THEY BURNT DOWN

(1) they do?

(10') THE ONES THAT--

(2") what if
i was in a house
that was burning?

(11) I DON'T KNOW
(12) YOU COULD CHOKE OR SOMETHING

(3) i could choke
(4) and then what
would happen?

(13) YOU'D GO TO THE HOSPITAL

(5) and then what
would happen?

(14) AND YOU MIGHT DIE
OR SOMETHING LIKE THAT

1.35 (1) what would happen
if you were in a house
(2) and it was burning
on fire?

(1) I DON'T KNOW

(2) FOR ONE THING,
YOU MAKE SURE
YOU'RE NOT IN YOUR HOUSE
(3) BECAUSE IF IT BURNTS DOWN
(4) AND ALL THE FURNITURE FALLS OUT
(5) AND IT CA--
(6) AND THEY--
(7) YOU MAKE SURE
YOU'RE NOT IN YOUR HOUSE
WHEN IT CATCHES ON FIRE
AND BURNTS DOWN
(8) AND ALL THE FURNITURE WILL FALL OUT
(9) CAUSE IF YOU STAY IN IT
(10) AND IT CATCHES ON FIRE REAL QUICK
AND BURNTS DOWN
(11) YOU'LL DIE

(3) boy, you would,
wouldn't you?

(12) YEAH

This then is the nature of the performance data which is stock and trade for a clinical language study. One of the first steps in analysis is to begin the refinement of this data once it is recognized that mental phenomenon is recorded in the transcript. Actual performance data such as this has become rare in psychological studies and yet in case studies this is necessary for explicit certainty to a particular client. As difficult as the task of characterizing individual performance data is known to be, it is important for clinical studies not to lose sight of the performances in the refinements of grammatical analysis. The claims for a psychological reality of various forms of grammar may rest not only upon learnability or universality, but also upon how the form of grammar breaks down in disability. The analysis of grammatical malfunctioning is a central concern in clinical studies and the motivating elegence in the use of generative methods is the variety of performance breakdowns due to incompetence of the client.

2.0 Grammatical Analysis

Since the purpose of this study is the description of language disability, it is an important methodological issue to define the analysis in a manner which does not assume the specific structure of a particular language at the core of the procedure. Most analyses of language disability have explicitly assumed the task of comparing a client's performance ability against a specific grammar of English. While there may be some sense in doing this with cases of traumatic aphasia in which language is lost, there seems little point in such comparison for deviantly communicating persons who have never spoken by the same rules as the linguistic community. To depart from the method of surface structure comparison, this work requires an analysis which is general enough to describe any simple language-- artifical ones; certain fragments of natural languages, like English, Spanish, or Hittite; and especially the simple expressions of very young children and some communication handicapped persons. The artificial languages are of extra use since they may be explicitly constructed of known quality and thereby be of use in the definition and calibration of the analytic tools.

A language is defined for a generative grammar as a set of all of the sentences of that language. The size of a language may then be subject to variation. Some languages may consist of only a small set of specifically listed sentences. The languages of some computer programs, some very small children, and some aphasic persons may have finite limits on the length or number of sentences in their language. Other languages can cycle some phrase structures endlessly and thereby permit sentences

of endless diversity or length. With these variations possible, the problem of characterizng a language cannot rely upon the exhaustive listing of sentences since there may be infinitely many of them. For the purpose of clinical case studies, the language of a client is described from a set of sentences taken from actual perfromances and are selected to represent that client's abilities in a systematic way.

A grammar is a set of rules which describe the structure and meaning obtained by combining the words into sentences. Given the set of words as basic expressions, a syntactical and semantical grammar relates these basic expressions to each other in a way that eventually refers to a model interpretation of the situation or state of affairs. The syntax is said to provide the structure of the sentences and the semantics is said to provide a corresponding truth-functional proposition.

A syntactical rule is a discrete part of the generative grammar and these rules consist of structural operations upon syntactic categories. Categorial rules of phrase structure have been developed for some time (Ajdukiewicz 1935; Bar-Hillel 1965). Categorial rules of syntax have a small number of beginning categories and any number of derived categories constructed from them. All categories are listed in the lexicon with their contents of basic expressions. Basic expressions are usually single words or affixes, and these serve as terminal elements for the phrase structure. Each categorial rule specifies which categories produce syntactic structures of the language and stipulates the linear order of its constituents. A well formed categorial rule combines its categories in accordance with type-relational definitions of the categories in that operation. The lexicon is organized by these

type-relational definitions, although all possible combinations of types may or may not occur in a language. Furthermore, the syntax may contain noncategorial rules in which definitionally unrelated categories are combined.

The simplest form of syntactic structure is known as a phrase. A sentence is a special kind of phrase which has a truth value in the model interpretation. A clause is another type of phrase which has a complete definable truth value but it is embedded in a matrix sentence so that its truth conditions usually contribute to the overall interpretation of the matrix. This manner of building phrase structure in an isomorphic correspondence with semantical translations on a rule-by-rule basis is the legacy of Montague (1974).

For the semantical component of a generative grammar, the meaning of a sentence is found in the conditions for evaluating its truth in a particular or possible situation. Each rule of semantics corresponds to a phrase structure rule so that the meaning of the phrase is composed of the meanings of its constituents. To specify the meaning the a sentence is to specify the conditions under which that sentence may be true or false. The interpretation of a sentence involves a connection to model theoretical semantics in which all possible situations of a given domain are represented in sets of ontological primitives (Tarski 1944; Carnap 1947). Each rule of semantics has a defined relationship to such models which are composed of possible individual, situations, times, and other functions over logical constants. The manner of building models from simple set theory is a contribution of Friedman, Moran, and Warren (1977). An important intermediate step between the model interpretation

and the phrase structure is the translation into intensional logic. This is a predicate calculus whose semantics are familiar to semanticists, and it is within this 'deep' level of structure that the familiar logical operators and connectives play. These connectives include negation, conjunction, implication, equivalence, identity, inclusive disjunction, and so forth. The foundations for this modern form of propositional logic were developed by Frege (1879).

Beyond the direct interplay of syntax and semantics, the syntax in this study makes ocassional access to an additional kind of rule-- the transformations. These structural operations are included as postsemantic derivational processes. This is intended to be similar to the early Chomsky (1965) standard linguistic theory. Transformations are formally given as meaning-preserving operations upon complete initial phrase structures and do not affect propositional composition. This is to limit the transformations in the manner of the Katz-Postal (1964) hypothesis, which became a piece of standard methodology for a while. The use of this form of linguistic theory does make some modest difference in the results of a particular analysis; however, much of this difference is thought to be notational variance which are easily intertranslated with other linguistic models.[1] In the manner of Peters and Ritchie (1973),

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[1] Making transformations available in this manner is only for conceptual clarity and the somewhat wider acceptance of this linguistic theory over other possible theories. Chomsky's more recent extended standard theory allows transformations with trace markers to affect the semantical interpretation which is projected from the surface of the sentence. Cooper's (1975) discussions of Montague's semantical theory consider transformational grammar with more completeness than here.

the formalizations of transformations in this study will use the factorizations of labeled bracketing. These transformations do not figure heavily in the forthcoming analyses because of the formal simplicity of the particular client data; although, Bloom (1970) does introduce some transformations for early child language which have not been widely accepted. On this account the formal definitions of transformations may seem naive without consideration of the constraints upon their derivational application or the mechanism of cyclic ordering. These definitions of copy and delete operations should make explicit the relation between this analysis and other previous methods which may be more familiar.

To introduce the details of grammatical analysis, some effort is taken to formally define the analytic mechanisms in a manner which is free of any particular language. A specific grammar of English or French might be the result of applying some analytic method constructed as this one to some data from competent speakers of English or French. For this study, a small artificial language is used to define the syntactical and semantical devices which later will be used to describe client performance data. This method of definition is a contribution of logicians to linguistic inquiry.

2.1 Rules of phrase structure are operations which specify the structural relations which hold for one or more constituents. These constituents are either: (i) phrases which are the output of other syntactical operations, or (ii) basic expressions from the lexicon. The simple ordered language, 2.10, is constructed from the 2.11 lexicon by a strict categorial syntax, 2.12.

2.10 An arbitrary language

A P	A A R	A PN	B Q D B PN	T X Q
B P	A B S	A PNN	A P C B P	T Y Q
A Q	B A S	B B SN	B A RN C B Q	U X B SN
B Q	B B S	B A RN	A A P D A A PN	U Y T X R

As a matter of convenience, the capital case lettering is strictly reserved for actual tokens of the object language being described. This coincides with the conventions for transcription of client performances in the last section, but this will not be an important distinction for this artificial language whose actual tokens directly correspond with the output of the grammar. In most client data there are actual tokens which are ungrammatical by the analysis-- counterexamples and performance fragments. In theoretical discussion there are grammatical tokens which are predicted by the grammar but not actually in the particular set of data. The arrangment of 2.10 into five columns is purely an arbitrary feature for esthetic purposes. These are arranged to show grammatical progression, but the arrangement of the actual tokens of an object language could be presented in any order.

2.11 Lexicon of basic expressions

$\underline{t}$	:	
$\underline{e}$	:	$\underset{\sim}{A}$, $\underset{\sim}{B}$, $\underset{\sim}{X}$, $\underset{\sim}{Y}$
$\underline{t/e}$	:	$\underset{\sim}{P}$, $\underset{\sim}{Q}$
$\underline{(t/e)/e}$	:	$\underset{\sim}{R}$, $\underset{\sim}{S}$
$\underline{t/t}$	:	$\underset{\sim\sim}{+N}$
$\underline{t/tt}$	:	$\underset{\sim}{C}$, $\underset{\sim}{D}$
$\underline{(t//t)/e}$	:	$\underset{\sim}{T}$, $\underset{\sim}{U}$

The lexicon of a simple language contains the set of categories in which are found the basic expressions. Italic lettering is reserved for the description of syntactical categories while the boldface lettering is reserved for the basic expressions. Categories are defined by their categorial type-relations to one or more primitive categories. The primitive category, t , is the category of sentences. Any expression of type t has a truth value by the semantical component. In the 2.11 lexicon there are no basic expressions listed in this category; therefore, all sentence expressions of the language must derived by syntactical operations. It is possible to enter some expressions as basic sentences which unitary syntactical structure and a noncompositional interpretation. Some idiom chunks could be treated as such. The other primitive category, e , is the category of entities-- the basic terms of the 2.10 language.

The compositionally related categories are defined by their combinatorial abilities with the primitives. The slash notation is of the form: to make an α , / , it takes a β where α , β are metavariables over syntactical categories. Greek lettering is reserved for these variables in the metalanguage. It is required that α/β and $\alpha//\beta$ receive identical interpretations in the semantics even though they are distinct syntactic categories. the form $\alpha/\beta\beta$ is a category of expressions which make an α by taking two expressions of type β . Parentheses in the slash notation are used for disambiguation.

In the 2.11 lexicon there are two categories of predicates, t/e and (t/e)/e . There are also three categories of sentence operators: t/t is the simple modifier for negation and other single sentence oper-

ators, t/tt is a category of connectives, and (t//t)/e is a category of phrase-building sentence modifiers. The single basic expression in t/t is a suffix-- the + indicating the direction of affixing to the next lexical item in the terminal string of basic expressions.

Categorial grammars are often constructed with the two primitives t and e ; although, more primitives could be identified if needed. The metalinguistic principle of simplicity constrains the number of primitives to the fewest necessary for adequate description of the object language.

2.12 Syntax of phrase structure

S1 $t \rightarrow e\ t/e$

S2 $t/e \rightarrow e\ (t/e)/e$

S3 $t \rightarrow t\ t/t$

S4 $t \rightarrow t\ t/tt\ t$

S5 $t \rightarrow t//t\ t$

S6 $t//t \rightarrow (t//t)/e\ e$

S7 $e \rightarrow A , B , X , Y$

S8 $t/e \rightarrow P , Q$

S9 $(t/e)/e \rightarrow R , S$

S10 $t/t \rightarrow +N$

S11 $t/tt \rightarrow C , D$

S12 $(t//t)/e \rightarrow T , U$

The rules of phrase structure stipulate which combinations of the categories occur in the syntactical operations of the language. Even though the lexicon is constructed upon combinatorial principles among

the categories, not all possible combinations need occur in a specific language. The syntax precisely regulates the phrase structure of the language, and occasionally rules may not coincide directly with the type-relational definitions in the lexicon. Such rules which do not operate in the manner of the categorial definitions are called noncategorial rules. The analysis of natural languages is often faced with admitting noncategorial rules of phrase structure; however, a metalinguistic principle of categoriality generally favors a grammar in which the phrase structure does coincide with the type relations of the lexicon. Some effort is taken with the 2.12 syntax so that it is uniformly categorial while noncategorial rules will be seen in natural data later.

All phrase structure rules are of the form: if α then β... where α is any single category and β... is any strictly ordered string of categories. The rules S1-S6 are of this form called rewriting rules. The phrase structure rules S7-S12 are known as lexical entry rules and have the form: if α then $\underset{\sim}{\beta}$ where α is any single category and $\underset{\sim}{\beta}$ is any single basic expression of that category. The commas in phrase structure notation are a short-hand manner of representing a closely related subset of rules having the same nonterminal category, but alternatively different lexical items which are separated by the commas. It should be understood that there is one unique lexical entry rule for each distinct lexical item.

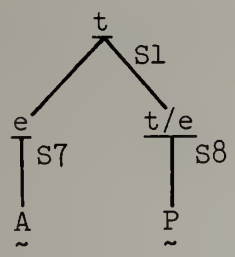
Syntactical operations generally consist of ordering constituents or the affixing of them. In languages such as English, ordering is a major property of the syntax while in other languages like Russian the

affixing of words with grammatical role markers is the major device of syntax while word order is relatively free. The strict ordering convention for the phrase structure of this study is provided here as a matter of convenience in dealing with the small English influenced samples. This should not be taken as a fundamental ordering principle of all grammars. As many languages have free word orders, it should be possible for the language of some disabled people to make use of less strict ordering than expected by the linguistic community-- especially where a self-made or idiosyncratic language may exist. The metalinguistic decision to use a strictly ordered phrase structure provides conceptual simplicity for the grammars of this study in relation to their data, and this decision should not be taken as a general solution to the problems of a uniform grammar for all languages, even though this goal is rather attractive and eventually necessary to learning theory.

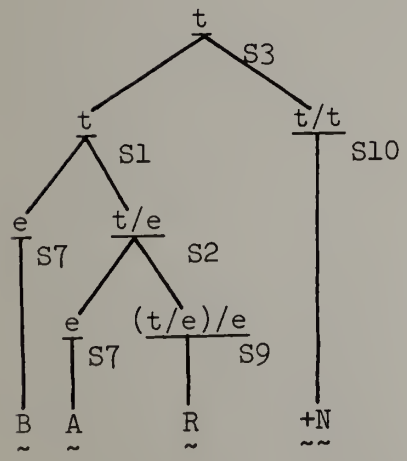
With these conventions above, an analysis tree and a derivation can be defined in order to connect the grammar to actual examples of sentences in the object language. An analysis tree is a familiar visualization of syntactical structure by which derivational history is illustrated. Each junction of an analysis tree is called a node, and each of these is double labeled with the name of its category and the number of rule which operates to result in the immediate constituents. Special abbreviated node labels will later be assigned to each category as the categorial definitions of this section rapidly become too cumbersome for diagraming and mnemonic purposes. A derivation specifies the serial order of syntactical operations. Each derivation begins with an exponential entry-- a beginning point much like the hypothetical entry in the deriva-

tion of deductive inferences in propositional logics. The exponent of a syntactically connected expression is the category to which the whole composite expression belongs. Each successive line of a derivation is the result of a single syntactical operation from the grammar upon the preceeding line. Notice the relations between an analysis tree and its derivation in each of the following. The derivation contains more information than the analysis tree. The tree diagrams have a familiar form which is quickly appreciated, but they lack the information about the order of rule application contained in the derivational history.

2.13 Analysis trees and derivations



i.	[t]	exponent
ii.	[[e][t/e]]	by S1
iii.	[[[A]][t/e]]	by S7
iv.	[[[A]][[P]]]	by S8

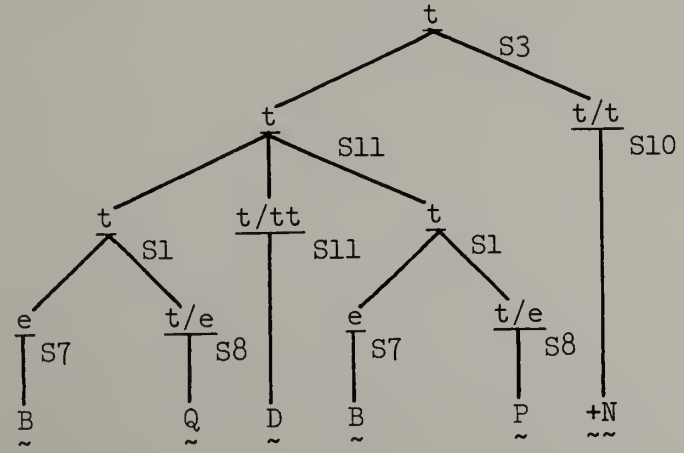


i.	[t]	exponent
ii.	[[t][t/t]]	by S3
iii.	[[[e][t/e]][t/t]]	by S1
iv.	[[[e][[e][(t/e)/e]]][t/t]]	by S2
v.	[[[[B]][[e][(t/e)/e]]][t/t]]	by S7
vi.	[[[[B]][[[A]][(t/e)/e]]][t/t]]	by S7
vii.	[[[[B]][[[A]][[R]]]][t/t]]	by S9
viii.	[[[[B]][[[A]][[R]]]][[+N]]]	by S10

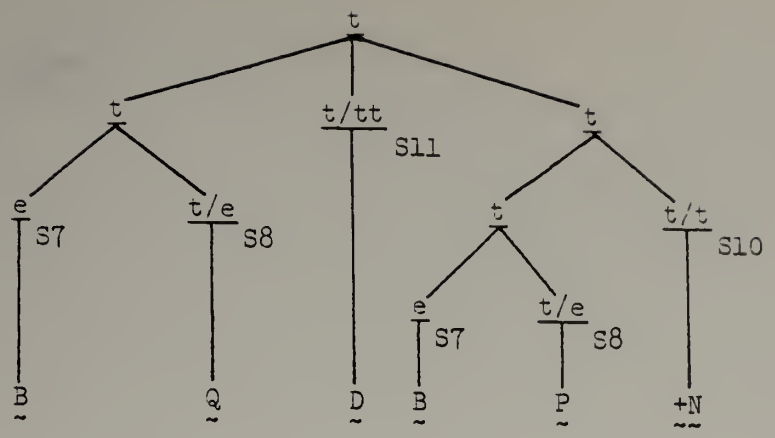
The final line of a derivation is called a symbolization of the syntactic structure thus derived, and it is an ordered string of basic expressions, explicitly generated by operation of the syntactic rules. A symbolization is somewhat different than the actual sentence of the object language. For instance, ...R +N... appears in the symbolization and should be compared to ...RN... in the object language. The operation of some unspecified but intuitive device of morphology is not a feature and so the inflection of lexical items is unspecified. In addition to such trivial differences between a derived symbolization and an actual token of the object language, a symbolization is the result of a particular derivation and the relationship between each line item is indicated by square bracketing. In an ambiguous language, such as 2.10, some of the sentences may be assigned more than one symbolization: each differing in the bracketed relationships between expressions and each having a different corresponding analysis tree.

2.14 Analysis trees and symbolizations of an ambiguous sentence

[[[B[Q]]D[[B[P]]+N]]]



[[B[Q]]D[B[P]]+N]



Bracketing in a symbolization is often suppressed for parsimony since it provides the same information as an analysis tree. Selected bracketing may be used gratuitously to illustrate particular line item relations-- known as scope relations-- where there may be doubt or deserve extra emphasis. It is also possible to label each bracket with the category to which the constituents within belong.

Both the analysis tree and the derivation are operational devices which connect the rules of the grammar to empirical examples of sentences of the language. Thus, the sentence, A A R , in the 2.10 language is grammatical by the 2.12 syntax because there exist a well-formed analysis tree and derivation for that sentence. These devices may also define some nonempirical or even nontheoretical examples of sentences. It may be noticed that the sentence, Ø B B R , is not found in 2.10 although it is grammatical by the syntax; and furthermore, the sentence, * A B P , is neither found in the language nor grammatical by the 2.12 syntax.

2.15 Ø-sentence — Analytic punctuation for a sentence which is grammatical but not actually listed in the finite set of sentences

presently being analyzed. Such a sentence is said to be predicted by the grammar since there exists at least one well-formed analysis tree and derivation for such, although no example of it may have been observed.

2.16 *-sentence — Analytic punctuation for a sentence which is ungrammatical since no well-formed analysis tree and derivation can exist for such a sentence in accordance with the grammar. An example of such a sentence in the actual language being analyzed is said to be a counter-example since it is not predicted by the grammar.

Both of these analytic punctuation symbols for hypothetical sentences are useful devices in discussing an analysis and should not be confused with transcript punctuation which is part of the data. Analytic punctuation does advance theoretical claims for consideration while the transcript punctuation does not.

2.2 Rules of predicate logic are used recursively to define the set of meaningful expressions of an interpreted language. To understand the meaning of a sentence, the various conditions under which that sentence is true or false must be known; and furthermore, the meaning of a sentence must depend upon the systematic composition of its parts. For a sentence to be interpreted, the meaning of that sentence is related to a set-theoretical model of the situation or state of affairs within the domain of discourse.

Traditional logics have two truth values: true and false. Logics with other numbers of values are possible, but these shall not be considered here. As an abstract ideal of definitional purpose, an arbi-

trary language could be constructed from a single of each grammatical device-- that is, a single truth value, a single reference point, a single individual, a single term, a single predicate, a single connective, and so on. Since it is doubtful that such a language could be plausible for human communication, a grammatical analysis based upon such a descriptive framework might escape the definitional circularity of many psychological or mental theories. The metalinguistic decision to base this method upon a double of each device (except tense) is made with the intention to select the smallest psychologically plausible language for the definitions. A single time in the interpretative model is an arbitrary restriction for simplicity since none of the child or disability data contain tensing.

The semantical component of the grammar contains several subcomponents: an intensional logic which is a 'reasonable first hypothesis for a universal language of logical form' (Partee 1977); an interpretational model which specifies the relations between the things referred to in domain of discourse; and the semantical rules defining the relationship between the logic and the model. The rules which translate from phrase structures to logical expressions correspond on a one-to-one level, so that a derivation of a propositional symbolization will directly correspond to a syntactical analysis tree of the initial phrase structure.

This form of semantical rule which translates from the syntax into an expression of intensional logic is an indirect double-syntax method but this is not intended to obscure the semantics. Truth functional operations define the semantical conditions for sentences to be true

assertions in reference to the modeled situation. Rather than presenting the semantics of a language directly with its syntax, Montague (1974: PTQ and UG) uses this method of translation from syntax to logic whose intensional semantics are explicit and familiar to semanticists. The easy convenience of this translation method has made it popular in the most subsequent research, although the double syntax contains some power in assymetrical relations between the phrase structure and logic. A more direct method of representing semantics (Montague 1974: EFL) may eventually become preferred once the issues become familiar. As a psychological theory there may be some nontrivial differences bewteen the direct and indirect semantics (Partee 1977); however, the logical translation rules shall be used here.

The structure for meaningful expressions of intensional logic are defined in 2.21. The denotative categories of the logic are called semantical types, and the greek lettering are distinct metavariables over these types: α , β are distinguished for any type in the logic; φ , ψ are distinguished for sentence-corresponding types. Many basic expressions translate directly into logical constants, so there are as many constants as needed for the lexicon, usually noted by marking the boldface expression, as in $\underset{\sim}{A}'$. The intensional logic makes use of as many variables as needed for the semantical types. Logical variables are written with italic lettering and are sometimes numbered by subscript to avoid confusing two variables of the same type. The use of v_n is distinguished for any logical type; u_n for the type of individuals; x_n for the type of individual concepts, and so on. There is a special semantical function, G , for assigning elements of the model interpreta-

tion of logical variables when specifying the meaning of sentences. The definitions of semantical types are noted in angle bracket notation which directly corresponds to the slash notation of the syntactical categories, but using an additional primitive, $\underline{s}$, for the senses of a referent in an intensional model.

2.21 Meaningful expressions of intensional logic

a.	$\underset{\sim}{K}'$	Every constant, $\underset{\sim}{K}'$, of any type is a meaningful expression.
b.	$\underline{v}_n$	Every variable, $\underline{v}_n$, of any type is a meaningful expression.
c.	$\lambda \underline{v}_n \ \beta$	The lambda-abstraction of a variable, $\underline{v}_n$, of any type $\langle \underline{a} \rangle$ is a function from from expression, α , of type $\langle \underline{a} \rangle$ to an expression, β , of type $\langle \underline{b} \rangle$, whenever α is assigned in place of $\underline{v}_n$. The lambda-abstract is a meaningful expression of type $\langle \underline{a},\underline{b} \rangle$.[2]
d.	$\alpha(\beta)$	The value of the function, α , of type $\langle \underline{b},\underline{a} \rangle$ for the argument, β , of type $\langle \underline{b} \rangle$ is a meaningful expression of type $\langle \underline{a} \rangle$.

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[2]Unfortunately, the study of semantics does not uniformly use the greek lettering as metavariables over categories. The lambda, λ , is the only greek letter which appears as a symbol in the logical expressions containing an open variable. This usage was introduced by Church (1941) and has been retained since in the semantical literature. In a similar fashion, greek letter epsilon, ε , is usually reserved as a metasymbol for set membership, but this usage can be avoided here for simplicity.

e.	$\alpha = \beta$	The identity formula where α, β are any expressions of the same type is a meaningful expression of type <t>.
f.	$\neg \varphi$	The negative formula is a meaningful expression of type <t>.
g.	$\varphi \wedge \psi$	The conjunction formula is a meaningful expression of type <t>.
h.	$\varphi \vee \psi$	The disjunction formula is a meaningful expression of type <t>.
i.	$\varphi \rightarrow \psi$	The conditional formula is a meaningful expression of type <t>.
j.	$\varphi \leftrightarrow \psi$	The equivalence formula is a meaningful expression of type <t>.
k.	$\vee v_n \varphi$	The existential quantification of a variable, v_n, of any type is a meaningful expression of type <t>.
l.	$\wedge v_n \varphi$	The universal quantification of a variable, v_n, of any type is a meaningful expression of type <t>.
m.	$? \varphi$	The questioned formula radical is a meaningful expression of type <t>.
n.	$\hat{}\alpha$	The intension of an expression, α, of any type <a> is a meaningful expression of type <s,a>.
o.	$\check{}\alpha$	The extension of an expression, α, of type <s,a> is a meaningful expression of type <a>.

The semantics of this intensional logic has two major parts: the rules of composition for meaningful expressions; and the reference to a

set-theory model containing the state descriptions. A metalinguistic principle of compositionality requires that the meaning of a complex expression must be built up from the smaller expressions in a systematic way. Thus in the semantical rules, 2.22 which follow, any expression of type $\langle \underline{t} \rangle$ from the logic is given a formal correspondence to syntactical sentences and can be assigned a truth value, $\{1,0\}$, from the model. The value, 1 , is given as true in reference to a portion of the model and the value, 0 , is reserved for falsehood. The set theory notation, $F(\underset{\sim}{K}')$, refers to a function from logical constants to sets of reference points, I , in the model, M . A special semantical function, $G(\underline{v}_n)$, is a model interpretation function which has domain over variables of any type and ranges over the set of possible denotations of the corresponding type. This G-assignment provides possible values for the variables in the logical expressions. Quantification also concerns some special functions related to variable assignments. The existential function, $K([\varphi]^{M,I,G'})$, is a maximal assignment function whose value is true when there exist at least one value of G-assignment for the quantified variable such that φ is true. The G' function is like the G-assignment with the possible difference that $G'(\underline{v}_n)$ is the value assigned for the variable such that the truth conditions for φ can be satisfied. The universal function, $L([\varphi]^{M,I,G'})$, is a minimal assignment function so that φ must be true for all values of G-assignment to the variable.

The semantical rules, 2.22, are only stated once in this study because most of the analytic work on the language samples is translation from the phrase structure into the intensional logic. Since Montague (1974) first introduced this indirect technique of translation, it has

become the popular basis of subsequent work. Actual semantical rules are only given once in this study as they give the interpretation for expressions of intensional logic and the subsequent grammars will give translation rules matching the syntax to this logic. This kind of analysis with logical translation does claim some psychological reality to the level of intensional logic, and this could become a matter of empirical verification once the method becomes familiar enough to tease out the relevant data. In the meantime, the intensional logic is a plausible hypothesis to approximate some internal level of language processing which is universal for all specific natural languages.

2.22 Semantical rules of intensional logic

a. $[\underset{\sim}{K}']^{M,I,G} = F(\underset{\sim}{K}')(\langle i \rangle)$

b. $[\underline{v}_n]^{M,I,G} = G(\underline{v}_n)$

c. $[\lambda \underline{v}_n\ \beta]^{M,I,G}([\alpha]^{M,I,G}) = [\beta]^{M,I,G'}$

d. $[\ \alpha(\beta)\ ]^{M,I,G} = [\alpha]^{M,I,G}([\beta]^{M,I,G})$

e. $[\ \alpha = \beta\ ]^{M,I,G} = 1 \leftrightarrow [\alpha]^{M,I,G} = [\beta]^{M,I,G}$

f. $[\ \neg \varphi\ ]^{M,I,G} = 1 \leftrightarrow [\varphi]^{M,I,G} = 0$

g. $[\ \varphi \wedge \psi\ ]^{M,I,G} = 1 \leftrightarrow [\varphi]^{M,I,G} = 1 \wedge [\psi]^{M,I,G} = 1$

h. $[\ \varphi \vee \psi\ ]^{M,I,G} = 1 \leftrightarrow [\varphi]^{M,I,G} = 1 \wedge [\psi]^{M,I,G} = 1$
$\vee\ [\varphi]^{M,I,G} = 1 \wedge [\psi]^{M,I,G} = 0$
$\vee\ [\varphi]^{M,I,G} = 0 \wedge [\psi]^{M,I,G} = 1$

i. $[\varphi \rightarrow \psi]^{M,I,G} = 1 \leftrightarrow [\varphi]^{M,I,G} = 1 \wedge [\psi]^{M,I,G} = 1$
$\vee [\varphi]^{M,I,G} = 0 \wedge [\psi]^{M,I,G} = 1$
$\vee [\varphi]^{M,I,G} = 0 \wedge [\psi]^{M,I,G} = 0$

j. $[\varphi \leftrightarrow \psi]^{M,I,G} = 1 \leftrightarrow [\varphi]^{M,I,G} = 1 \wedge [\psi]^{M,I,G} = 1$
$\vee [\varphi]^{M,I,G} = 0 \wedge [\psi]^{M,I,G} = 0$

k. $[\forall \underline{v}_n \varphi]^{M,I,G} = 1 \leftrightarrow K([\varphi]^{M,I,G'}) = 1$

l. $[\wedge \underline{v}_n \varphi]^{M,I,G} = 1 \leftrightarrow L([\varphi]^{M,I,G'}) = 1$

m. $[\ ?\varphi\ ]^{M,I,G} = 1 \leftrightarrow [\varphi]^{M,I,G} = 1$

n. $[\hat{}\alpha]^{M,I,G} = [\alpha]^{M,G}$

o. $[\check{}\alpha]^{M,I,G} = [\alpha]^{M,I,G}(\langle i \rangle)$

It is now a rather straightforward task to return to the description of the arbitrary object language, 2.10. A set of direct correspondences need to be established for the syntactical categories to be mapped onto the sets of semantical types: these being denotative categories of the logic. These semantical types can be determined from the syntactic categories by a mapping function to semantical types: $f(\gamma)$ is assigned to $\langle\gamma\rangle$ where γ is a distinguished metavariable over primitive categories; $f(\alpha/\beta)$ and $f(\alpha//\beta)$ are assigned to $\langle\langle \underline{s}, f(\beta)\rangle, f(\alpha)\rangle$ where α,β are the usual metavariables over any category and $\underline{s}$ is an additional categorial primitive for the senses of expressions from different reference points of an intensional interpretation; and, $f(\alpha/\beta\beta)$ is assigned to $\langle\langle\langle \underline{s}, f(\beta)\rangle, \langle \underline{s}, f(\beta)\rangle\rangle, f(\alpha)\rangle$.

The syntactical-semantical correspondences in 2.23 are provided for the 2.10 object language in accordance with this mapping function, and it may be helpful to refer to this later in discussion when it is preferable to use the semantical designations for various types.

2.23 Correspondences of syntactical categories to semantical types

SYNTACTIC CATEGORY	SYNTACTIC DESIGNATION	SEMANTIC EXTENSIONAL TYPE	SEMANTIC DESIGNATION	SEMANTIC INTENSIONAL TYPE	SEMANTIC DESIGNATION
t	sentences	$\langle t \rangle$	truth values	$\langle s,t \rangle$	propositions
e	terms	$\langle e \rangle$	individuals	$\langle s,e \rangle$	individual concepts
t/e	intransitive predicates	$\langle\langle s,e \rangle,t \rangle$	sets of individual concepts	$\langle s,\langle\langle s,e \rangle,t \rangle\rangle$	properties of individual concepts
(t/e)/e	transitive predicates	$\langle\langle s,e \rangle,\langle\langle s,e \rangle,t \rangle\rangle$	extensional relations between individual concepts	$\langle s,\langle\langle s,e \rangle,\langle\langle s,e \rangle,t \rangle\rangle\rangle$	intensional relations between individual concepts
t/t	sentence modifiers	$\langle\langle s,t \rangle,t \rangle$	sets of propositions	$\langle s,\langle\langle s,t \rangle,t \rangle\rangle$	properties of propositions
t//t	sentence modifiers	$\langle\langle s,t \rangle,t \rangle$	sets of propositions	$\langle s,\langle\langle s,t \rangle,t \rangle\rangle$	properties of propositions
(t//t)/e	modifier heads	$\langle\langle s,e \rangle,\langle\langle s,t \rangle,t \rangle\rangle$	extensional relations between propositions and individual concepts	$\langle s,\langle\langle s,e \rangle,\langle\langle s,t \rangle,t \rangle\rangle\rangle$	intensional relations between propositions and individual concepts
t/tt	sentence connectives	$\langle\langle\langle s,t \rangle,\langle s,t \rangle\rangle,t \rangle$	sets of ordered propositions	$\langle s,\langle\langle\langle s,t \rangle,\langle s,t \rangle,t \rangle\rangle$	properties of ordered propositions

In the following translation rules, 2.24, each rule of the 2.12 phrase structure is given a corresponding expression of intensional logic. The categorial treatment of the grammar results in the logical connectives of propositional logic-- $\neg$, $\vee$, $\wedge$, $\veebar$, and $\barwedge$ -- being entered as lambda-abstract with P-variables over propositions. While this adds slightly to the derivational complexity of the grammar, the strict categorial grammar gives a uniform functional application for the phrasal rules: T1, T3-T6. Much of this unsightly lambda-abstraction is usually avoided by relaxing strict categoriality to an approach known as the syncategorial treatment which enters the logical connectives directly in logical expressions rather than as lexical entries.

2.24 Semantics of logical translation[3]

T1 $\underline{t/e}(\hat{}\underline{e})$

T2 $\lambda\underline{x}\,[\underline{\{t/e\}/e}(\underline{x},\hat{}\underline{e})]$

T3 $\underline{t/t}(\hat{}\underline{t})$

T4 $\underline{t/tt}(\hat{}\underline{t},\hat{}\underline{t})$

T5 $\underline{t//t}(\hat{}\underline{t})$

T6 $\underline{\{t//t\}/e}(\hat{}\underline{e})$

T7 $\underset{\sim}{A}'$, $\underset{\sim}{B}'$, $\underline{u}_1$, $\underline{u}_2$

T8 $\underset{\sim}{P}'$, $\underset{\sim}{Q}'$

T9 $\underset{\sim}{R}'$, $\underset{\sim}{S}'$

T10 $\lambda\underline{P}_n \neg[\check{}\underline{P}_n]$

T11 $\lambda\underline{P}_1\lambda\underline{P}_2\,[\check{}\underline{P}_1 \wedge \check{}\underline{P}_2]$, $\lambda\underline{P}_1\lambda\underline{P}_2\,[\check{}\underline{P}_1 \vee \check{}\underline{P}_2]$

T12 $\lambda\underline{x}\lambda\underline{P}_n\forall[\check{}\underline{x}][\check{}\underline{P}_n]$, $\lambda\underline{x}\lambda\underline{P}_n\wedge[\check{}\underline{x}][\check{}\underline{P}_n]$

To complete the specification of the semantical component, it is necessary to define a set theoretical model for the state descriptions to which the object language, 2.10, is said to refer. A specified model, M, contains a set of possible individuals which are the collection of

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[3] It should be noted that parentheses symbols in the intensional logic are used in the set theoretical manner for containing a function's arguments. The disambiguating parentheses in the slash notation of the categorial syntax are of different purpose, and hence have been marked, $\{\ \}$, to avoid confusion. This will not be necessary later when node labels can be used in place of the categorial definitions. The variable, $\underline{P}_n$, is of type $<\underline{s},\underline{t}>$.

things refered to within the domain of discourse and these provide the ontological basis for the model. A pair of curly brackets, { } , contain unordered sets of model elements, usually in pairs; and, parentheses, ( ) , contain ordered pairs in the model. Besides the set of possible individuals, the model contains sets of possible truth values, {1,0} ; and sets of reference points, {I0, I1, ... , IN} ; and the sets of function values from basic expressions to the intensional reference points. It is the set of reference points which distinguish the intensional model from the extensional models which contain only a single state description. Specifying the set structure for a model begins with rather simple recursive principles which combine the model elements in all possible combinations-- a cartesian product of the individuals, truth values, and reference points. The model contains a reference for every possible relationship between the elements, and the task of the semantical component of the grammar is to compose meanings in expressions which indicate subsets within the model that is being refered to. The pragmatical compnent of the grammar should also aid in limiting the refered to part of the model through discourse conventions, conversational integrity, and so forth. Unfortunately, the formalization of pragmatics is sometime in future, hopefully not too remote. In the meanwhile, psychologically oriented theories of semantics are faced with the problem of specifying models which exponentially explode in size relative to the number of lexical items in the language. The cartesian products of even quite small languages produce enormous models which are rarely specified completely because of the size. Mathematicians in the development of model theory

have produced techniques of increasing generality so that the specification of the set structure of the model is assumed without need of direct representation. Model theoretics allows semantics to account for potentially infinite sets of possible individuals, worlds, and times only some of which are ever actually refered to. For psychologic studies, however, this aspect of generality does not resolve the main problem of representing a finite model which is refered to in actual sets of sentences used in conversation. There are a number of ways to limit the size of finitely specified models, such as meaning postulates or altering the cartesian principle and generate only partial models rather than total. These are more or less systematic techniques; but lacking a formal pragmatics, they appear unpleasingly arbitrary for psychological purposes at present. The specified model, 2.25 , for the 2.10 object language is arbitrarily restricted to only two reference points, {I1,I2} , for the purposes of analytic definition. Other methods for representing finite models shall be mentioned later when used in the study of actual performance data, but the techniques for limiting the exponential size of total models shall be no less arbitrary but perhaps satisfactory for use.

2.25 Denotative Descriptions and Model Specifications

Set of Possible Individuals {{A1,A2},

Set of Reference Points {I1,I2},

Set of Truth Values {1,0},

Values of Intensional Functions

$D_{\underline{<s,e>}}$ $\{F(\underset{\sim}{A}') = \{(I1,A1),(I2,A1)\}$,

$F(\underset{\sim}{B}') = \{(I1,A2),(I2,A2)\}$,

$D_{\underline{<s,<<s,e>,t>>}}$ $F(\underset{\sim}{P}') = \{(I1,\{(\{(I1,A1),(I2,A1)\},1),$

$(\{(I1,A2),(I2,A2)\},0)\})$,

$(I2,\{(\{(I1,A1),(I2,A1)\},0),$

$(\{(I1,A2),(I2,A2)\},1)\})\}$,

$F(\underset{\sim}{Q}') = \{(I1,\{(\{(I1,A1),(I2,A1)\},0),$

$(\{(I1,A2),(I2,A2)\},1)\})$,

$(I2,\{(\{(I1,A1),(I2,A1)\},0),$

$(\{(I1,A2),(I2,A2)\},1)\})\}$,

$D_{\underline{<s,<<s,e>,<<s,e>,t>>>}}$ $F(\underset{\sim}{R}') = \{(I1,\{(\{(I1,A1),(I2,A1)\},$

$(\{(I1,A1),(I2,A1)\},1),$

$(\{(I1,A2),(I2,A2)\},1)\})$,

$(\{(I1,A2),(I2,A2)\},$

$(\{(I1,A1),(I2,A1)\},1),$

$(\{(I1,A2),(I2,A2)\},0)\})\})$,

$(I2,\{(\{(I1,A1),(I2,A1)\},$

$(\{(I1,A1),(I2,A1)\},0),$

$(\{(I1,A2),(I2,A2)\},1)\})$,

$(\{(I1,A2),(I2,A2)\},$

$(\{(I1,A1),(I2,A1)\},1),$

$(\{(I1,A2),(I2,A2)\},0)\})\})\}$,

$$F(\underset{\sim}{S}') = \{(I1,\{(\{(I1,A1),(I2,A1)\},$$
$$(\{(I1,A1),(I2,A1)\},0),$$
$$(\{(I1,A2),(I2,A2)\},1)\}),$$
$$(\{(I1,A2),(I2,A2)\},$$
$$(\{(I1,A1),(I2,A1)\},0),$$
$$(\{(I2,A2),(I2,A2)\},0)\})\}),$$
$$(I2,\{(\{(I1,A1),(I2,A1)\},$$
$$(\{(I1,A1),(I2,A1)\},0),$$
$$(\{(I1,A2),(I2,A2)\},1)\}),$$
$$(\{(I1,A2),(I2,A2)\},$$
$$(\{(I1,A1),(I2,A1)\},1),$$
$$(\{(I1,A2),(I2,A2)\},0)\})\})\}\}\}$$

The 2.25 model interpretation explicitly gives the values of the intensional functions for the logical constants of the 2.10 object language. The set of possible denotations of the intensional type, <s,e> , is called the set of individual concepts because the semantical function selects an individual at each reference point. The constants, $\underset{\sim}{A}'$ and $\underset{\sim}{B}'$, are given as rigid designators in this model-- these functions pick out the same individual at all reference points. In some semantical studies the constants which correspond to term expressions are given as nonrigid designators which pick out different individuals from different reference points. The same name can refer to different people, but for this study the function of rigid designation is presented because it is simpler in model specifications and it is not too incompatible with the data later. The person names for very young children; MAMA, DADA, and the like; seem

properly analyzed with the simpler functions although there are some empirical complexities to be found in the earliest term expressions for individual identities.

The model denotations for the intransitive predicates, $\underset{\sim}{P}'$ and $\underset{\sim}{Q}'$, are called properties of individual concepts. For the constant, $\underset{\sim}{P}'$, there is a function which contains a truth value for each individual at each reference point. It has been specified that A1 has that property from the first reference point, I1, but not from the second, I2. The reverse is true of the other individual, A2. Concerning the property, $\underset{\sim}{Q}'$, the first individual nevers has this property while it is always true of the other.

The transitive expressions, $\underset{\sim}{R}'$ and $\underset{\sim}{S}'$, are intensional relations between individual concepts. The relation, $\underset{\sim}{R}'$, is not only transitive, but it is also reciprocal since the same individuals always stand in the same relation to each other. The R' relation is also reflexive since there is at least one reference point, eg. I1, where it is true that one individual stands in the $\underset{\sim}{R}'$ relation to itself. The $\underset{\sim}{S}'$ relation is given as transitive but neither reciprocal nor reflexive.

Concluding this section on the semantical component, it can be shown that each sentence of the object language has at least one derivation for an expression of intensional logic. A truth value for every sentence can be found in the model interpretation. For the intermediate step of translation into the intensional logic, the syntactical derivation introduced in 2.13 again appears for the semantical purpose of deriving the logical expressions by translation rules. The form of a

semantical derivation is not perfectly isomorphic with the syntactical derivation since the logical conversions of lambda-abstractions and the ˇ^-cancelations do not have direct syntactical correlates. These conversions are entered as unnumbered derivational reflexes, allowing the sequence numbering to emphasize the rule-by-rule translation process between syntax and the logic. The examples of semantical derivations in 2.26 are the same examples found in 2.13.

2.26 Semantical derivations

i.	$\underline{t}$	exponent
ii.	$\underline{t/e}(\hat{}\underline{e})$	by T1
iii.	$\underline{t/e}(\hat{}\underset{\sim}{A}')$	by T7
iv.	$\underset{\sim}{P}'(\hat{}\underset{\sim}{A}')$	by T8

i.	$\underline{t}$	exponent
ii.	$\underline{t/t}(\hat{}\underline{t})$	by T3
iii.	$\underline{t/t}(\hat{}[\underline{t/e}(\hat{}\underline{e})])$	by T1
iv.	$\underline{t/t}(\hat{}[\lambda\underline{x}\,[\underline{\{t/e\}/e}(\underline{x},\hat{}\underline{e})](\hat{}\underline{e})])$	by T2
	$\underline{t/t}(\hat{}[\underline{\{t/e\}/e}(\hat{}\underline{e},\hat{}\underline{e})])$	λ-convert
v.	$\underline{t/t}(\hat{}[\underline{\{t/e\}/e}(\hat{}\underset{\sim}{B}',\hat{}\underline{e})])$	by T7
vi.	$\underline{t/t}(\hat{}[\underline{\{t/e\}/e}(\hat{}\underset{\sim}{B}',\hat{}\underset{\sim}{A}')])$	by T7
vii.	$\underline{t/t}(\hat{}[\underset{\sim}{R}'(\hat{}\underset{\sim}{B}',\hat{}\underset{\sim}{A}')])$	by T9
viii.	$\lambda\underline{P}_n \neg[\check{}\underline{P}_n](\hat{}[\underset{\sim}{R}'(\hat{}\underset{\sim}{B}',\hat{}\underset{\sim}{A}')])$	by T10
	$\neg[\check{}\hat{}\underset{\sim}{R}'(\hat{}\underset{\sim}{B}',\hat{}\underset{\sim}{A}')]$	λ-convert
	$\neg\ \underset{\sim}{R}'(\hat{}\underset{\sim}{B}',\hat{}\underset{\sim}{A}')$	ˇ^-cancel

Since the intensional logic has explicit semantical rules, it is possible to apply the 2.22 semantical rules to the symbolizations of the logic and discover that $[\underset{\sim}{P}'(\hat{}\underset{\sim}{A}')]^{2.25,I1,G} = 1$ since the $\underset{\sim}{P}'$ property of the A1 individual from the I1 reference point. Alternatively, $[\underset{\sim}{P}'(\hat{}\underset{\sim}{A}')]^{2.25,I2,G} = 0$ from the other reference point. The interpretation of the negative expression above is false from both reference points since the $\underset{\sim}{R}'$ relation is true of A1 and A2 from I1 and I2 in the model.

2.3 Rules of syntactical transformations are here defined as post-semantical operations which change the structure of initial phrase markers without changing the semantical interpretation. These rules can be formalized upon the 2.13 syntactical derivations in a simple manner. A transformation is defined upon a derived symbolization of syntactical phrase structure-- a string of basic expressions within sets of brackets that have been labeled for the category which they derived from. The first step of a transformation is to factor the labeled string into a structural description, then two kinds of syntactic operation follow: factor copy or factor deletion. Since transformation can be specified as obligatory so that they must operate whenever an initial phrase marker meets the structural description, a movement transformation is here defined as an obligatory factor deletion upon the output of a factor copy. These are the three basic forms of transformations: copy, delete, and move.

Factorization is the central process in transformations which well-formed strings of labeled brackets are divided into smaller parts known as factors. A factor is any portion of the well-formed string which

contains at least one expression and does not have a rightmost left bracket nor a leftmost right bracket. More simply, a factor does not begin with] nor end with [and must have structural content. Strings of expressions may frequently be factored in more than one manner, so transformations are given a structural description of factors which are acceptable input for the structure transforming operations. The structural description of a transformation specifies the contents of some factors which must be present for the rule to operate. The structural descriptions usually require the use of metavariables--factors with specific content are sometimes separated by any number of unspecified factors. Greek lettering is again used for these metavariables over any syntactic structure in relation to the transforming factors.

Once a symbolization has been factored in manner which satisfies the structural description, the transformation either copies the contents of a factor at another place in the symbolization, or deletes the deletes the content of a factor. The conditions under which a transformation can perform its operations and constraints upon the possible structural descriptions for transformations are complex matters and are not considered in any detail here. Although the proper treatment of transformations is an important concern, these rules do not play a very central role in the studies of early syntax which follow. Consequently, many formal properties of transformations, like cyclic ordering, are only suggested here.

More illustrative purposes than formal definition, a single movement transformation is introduced in 2.30 which completes the grammar

for the 2.10 object language. The vertical columns of dots separate the factors in the transformation.

2.30 An obligatory tranformational rule

Quantifier Movement:

a. Structural description:

$$\alpha \vdots [_{\underline{t}}[_{\underline{t/\!/t}}\ \underline{\langle t/\!/t\rangle/e}\ \vdots\ [_{\underline{e}}\beta_{\underline{e}}]\ \vdots\ \delta\ \vdots\ [_{\underline{e}}\beta_{\underline{e}}]\ \zeta_{\underline{t}}]\ \vdots\ \eta$$

b. Factor copy:

$$\alpha \vdots [_{\underline{t}}[_{\underline{t/\!/t}}\ \underline{\langle t/\!/t\rangle/e}\ \vdots\ [_{\underline{e}}\beta_{\underline{e}}]\ \vdots\ \delta\ \vdots\ [_{\underline{e}}\underline{\langle t/\!/t\rangle/e}\ \beta_{\underline{e}}]\ \zeta_{\underline{t}}]\ \vdots\ \eta$$

c. Factor delete:

$$\alpha \vdots [_{\underline{t}} \qquad\qquad \delta \vdots [_{\underline{e}}\underline{\langle t/\!/t\rangle/e}\ \beta_{\underline{e}}]\ \zeta_{\underline{t}}]\ \vdots\ \eta$$

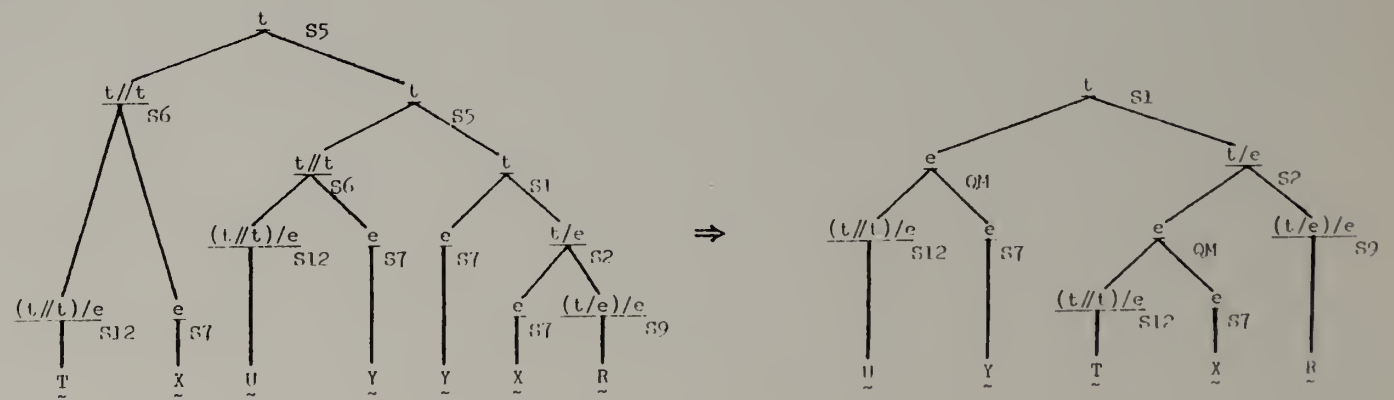
The complete derivational process for a transformed sentence of the object language is presented in 2.31 below. To emphasize the isomorphism between the syntax and semantics, the corresponding expressions are numbered sequentially line-by-line while the unique processes like logical conversions or transformational suboperations are unnumbered as derivational reflexes.

2.31 Syntactical and semantical derivations and analysis trees

i.	$\underline{t}$	exponent	i.	$\underline{t}$	exponent
ii.	$\underline{t/\!/t}\ \underline{t}$	by S5	ii.	$\underline{t/\!/t}\ (\hat{}\underline{t})$	by T5
iii.	$\underline{t/\!/t}\ \underline{t/\!/t}\ \underline{t}$	by S5	iii.	$\underline{t/\!/t}\ (\hat{}[\underline{t/\!/t}\ (\hat{}\underline{t})])$	by T5
iv.	$\underline{t/\!/t}\ \underline{t/\!/t}\ \underline{e}\ \underline{t/e}$	by S1	iv.	$\underline{t/\!/t}\ (\hat{}[\underline{t/\!/t}\ (\hat{}[\underline{t/e}\ (\hat{}\underline{e})])])$	by T1
v.	$\underline{t/\!/t}\ \underline{t/\!/t}\ \underline{e}\ \underline{e}\ \underline{(t/e)/e}$	by S2	v.	$\underline{t/\!/t}\ (\hat{}[\underline{t/\!/t}\ (\hat{}[\lambda\underline{x}\ [\underline{\{t/e\}/e}\ (\underline{x},\hat{}\underline{e})](\hat{}\underline{e})])])$	by T2
				$\underline{t/\!/t}\ (\hat{}[\underline{t/\!/t}\ (\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])])$	λ-convert
vi.	$\underline{(t/\!/t)/e}\ \underline{e}\ \underline{t/\!/t}\ \underline{e}\ \underline{e}\ \underline{(t/e)/e}$	by S6	vi.	$\underline{\{t/\!/t\}/e}\ (\hat{}\underline{e})(\hat{}[\underline{t/\!/t}\ (\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])])$	by T6
vii.	$\underline{(t/\!/t)/e}\ \underline{e}\ \underline{(t/\!/t)/e}\ \underline{e}\ \underline{e}\ \underline{e}\ \underline{(t/e)/e}$	by S6	vii.	$\underline{\{t/\!/t\}/e}\ (\hat{}\underline{e})(\hat{}[\underline{\{t/\!/t\}/e}\ (\hat{}\underline{e})(\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])])$	by T6
viii.	$\underset{\sim}{T}\ \underline{e}\ \underline{(t/\!/t)/e}\ \underline{e}\ \underline{e}\ \underline{e}\ \underline{(t/e)/e}$	by S12	viii.	$\lambda\underline{x}\lambda\underline{P}_{\underline{n}}\forall[\check{}\underline{x}][\check{}\underline{P}_{\underline{n}}](\hat{}\underline{e})(\hat{}[\underline{\{t/\!/t\}/e}\ (\hat{}\underline{e})(\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])])$	by T12
				$\lambda\underline{P}_{\underline{n}}\forall[\hat{}\underline{e}][\check{}\underline{P}_{\underline{n}}](\hat{}[\underline{\{t/\!/t\}/e}\ (\hat{}\underline{e})(\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])])$	λ-convert
				$\lambda\underline{P}_{\underline{n}}\forall[\underline{e}][\check{}\underline{P}_{\underline{n}}](\hat{}[\underline{\{t/\!/t\}/e}\ (\hat{}\underline{e})(\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])])$	ˇ^-cancel
				$\forall[\underline{e}][\hat{}[\underline{\{t/\!/t\}/e}\ (\hat{}\underline{e})(\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])]]$	λ-convert
				$\forall[\underline{e}][\underline{\{t/\!/t\}/e}\ (\hat{}\underline{e})(\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])]$	^ˇ-cancel
ix.	$\underset{\sim}{T}\ \underset{\sim}{X}\ \underline{(t/\!/t)/e}\ \underline{e}\ \underline{e}\ \underline{e}\ \underline{(t/e)/e}$	by S7	ix.	$\forall\underline{u}_{\underline{1}}\ [\underline{\{t/\!/t\}/e}\ (\hat{}\underline{e})(\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])]$	by T7
x.	$\underset{\sim}{T}\ \underset{\sim}{X}\ \underset{\sim}{\Pi}\ \underline{e}\ \underline{e}\ \underline{e}\ \underline{(t/e)/e}$	by S12	x.	$\forall\underline{u}_{\underline{1}}\ [\lambda\underline{x}\lambda\underline{P}_{\underline{n}}\forall[\check{}\underline{x}][\check{}\underline{P}_{\underline{n}}](\hat{}\underline{e})(\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])]$	by T12
				$\forall\underline{u}_{\underline{1}}\ [\lambda\underline{P}_{\underline{n}}\forall[\hat{}\underline{e}][\check{}\underline{P}_{\underline{n}}](\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])]$	λ-convert
				$\forall\underline{u}_{\underline{1}}\ [\lambda\underline{P}_{\underline{n}}\forall[\underline{e}][\check{}\underline{P}_{\underline{n}}](\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})])]$	ˇ^-cancel
				$\forall\underline{u}_{\underline{1}}\ [\forall[\underline{e}][\hat{}[\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})]]]$	λ-convert
				$\forall\underline{u}_{\underline{1}}\ [\forall[\underline{e}][\underline{\{t/e\}/e}\ (\hat{}\underline{e},\hat{}\underline{e})]]$	^ˇ-cancel

xi.	$\underset{\sim}{T}$	$\underset{\sim}{X}$	$\underset{\sim}{U}$	$\underset{\sim}{Y}$	$\underset{\sim}{e}$	$\underset{\sim}{e}$	$\underset{\sim}{(t/e)/e}$	by S7	xi.	$\forall \underset{\sim}{u}_1\ [\lambda \underset{\sim}{u}_2\ [\underset{\sim}{(t/e)/e}(\hat{}\underset{\sim}{e}, \hat{}\underset{\sim}{e})]]$	by T7
xii.	$\underset{\sim}{T}$	$\underset{\sim}{X}$	$\underset{\sim}{U}$	$\underset{\sim}{Y}$	$\underset{\sim}{Y}$	$\underset{\sim}{e}$	$\underset{\sim}{(t/e)/e}$	by S7	xii.	$\forall \underset{\sim}{u}_1\ [\lambda \underset{\sim}{u}_2\ [\underset{\sim}{(t/e)/e}(\hat{}\underset{\sim}{u}_2, \hat{}\underset{\sim}{e})]]$	by T7
xiii.	$\underset{\sim}{T}$	$\underset{\sim}{X}$	$\underset{\sim}{U}$	$\underset{\sim}{Y}$	$\underset{\sim}{Y}$	$\underset{\sim}{X}$	$\underset{\sim}{(t/e)/e}$	by S7	xiii.	$\forall \underset{\sim}{u}_1\ [\lambda \underset{\sim}{u}_2\ [\underset{\sim}{(t/e)/e}(\hat{}\underset{\sim}{u}_2, \hat{}\underset{\sim}{u}_1)]]$	by T7
xiv.	$\underset{\sim}{T}$	$\underset{\sim}{X}$	$\underset{\sim}{U}$	$\underset{\sim}{Y}$	$\underset{\sim}{Y}$	$\underset{\sim}{X}$	$\underset{\sim}{R}$	by S9	xiv.	$\forall \underset{\sim}{u}_1\ [\lambda \underset{\sim}{u}_2\ [\ \underset{\sim}{R}'(\hat{}\underset{\sim}{u}_2, \hat{}\underset{\sim}{u}_1)]]$	by T9

xv.	$[[\underset{\sim}{T}$	$[\underset{\sim}{X}]$	$\underset{\sim}{U}$	$\underset{\sim}{Y}\ \underset{\sim}{Y}$	$[\underset{\sim}{X}]\ \underset{\sim}{R}]$	QM Factor
	$[[\underset{\sim}{T}$	$[\underset{\sim}{X}]$	$\underset{\sim}{U}$	$\underset{\sim}{Y}\ \underset{\sim}{Y}$	$[\underset{\sim}{T}\ \underset{\sim}{X}]\underset{\sim}{R}]$	Factor Copy
	$[$		$\underset{\sim}{U}$	$\underset{\sim}{Y}\ \underset{\sim}{Y}$	$[\underset{\sim}{T}\ \underset{\sim}{X}]\underset{\sim}{R}]$	Factor Delete
xiv	$[[\underset{\sim}{U}$	$[\underset{\sim}{Y}]$	$[\underset{\sim}{Y}]\ \underset{\sim}{T}\ \underset{\sim}{X}\ \underset{\sim}{R}]$			QM Factor
	$[[\underset{\sim}{U}$	$[\underset{\sim}{Y}]$	$[\underset{\sim}{U}\ \underset{\sim}{Y}]\ \underset{\sim}{T}\ \underset{\sim}{X}\ \underset{\sim}{R}]$			Factor Copy
	$[$		$[\underset{\sim}{U}\ \underset{\sim}{Y}]\ \underset{\sim}{T}\ \underset{\sim}{X}\ \underset{\sim}{R}]$			Factor Delete



3.0 Grammatical Description of Early Child Language

The distinction between an infant and a child is the ability to speak. The development of this ability usually begins around the first year of life with an ever enlarging vocabulary of single word utterances until the end of the second year when words become joined together into syntactical structures of increasing complexity. Rather complete sentences are regularly spoken and understood by a child by the third year. The first period of single words when the first vocabulary develops is known as the holophrastic stage since it was early accepted that the first words did not represent isolated parts of speech but interpreted pragmatically with the value of complete sentences (Stern and Stern 1907; Bloch 1921; de Laguna 1927). The stage of early syntax has a somewhat clear beginning point in speech production when two words are produced in a single unit of intonation and are understood with a constant compositional interpretation.

The formal treatment for grammatical description of this early period of language development has been problemed at several levels: (i) the continuation of the holophrastic interpretation into the stage of syntactical growth; and, (ii) the lack of an explicit semantics. A general problem in defining stages of linguistic acquisition is the prolonged maintenance of holophrastic interpretation at sentence level when syntactical rules of phrase structure are known by the child. If the syntactical rules are discrete mental processes, the child may be defaulting in a conversation if the holophrase interpretation is thought to be very different from the rules of syntactical interpretation. It is

commonplace to exclude the holophrase from consideration in syntactical analyses as a matter of methodology, and reliance is placed upon average sentence length (mean length of utterances: Brown, Cazden, and Bellugi 1968) to pool the syntactical combinations into analyzable samples. The MLU practice usually defines the onset of syntactical combination to be 1.5 morphemes per utterance and thereafter dumps the holophrases from formal consideration. MLU has been one of the more resilient rubber rulers in child language: no form of adult grammar is organized by morpheme counting. The MLU methodology is based upon performance features of discourse, and thereby defaults in the formal treatment of mental competence since the child's ability to interpret holophrases is both unspecified and considered to be something very different from syntactical ability. This problem of holophrastic treatment is related to the lack of formal semantics in linguistic inquiry. There have been two general approaches to the inavailability of semantical analysis: the development of an autonomous syntax for which there need be no semantics; or the use of structural semantics which cannot be explicitly related to a generative syntax. To illustrate these practices, the benchmark works of Braine (1963) on pivot grammar and Bloom (1970) on melding phrase structure grammar with structural semantics are presented below.

The pivot grammar was introduced by Martin D. S. Braine (1963) as an attractive formal treatment for early child syntax because the simple binary structure it imparts to the first word structures seems the likely building block with which to begin syntax. At first blush it seems very reasonable to expect a child to combine single words into a structure of this sort. Braine's data sample consisted of cummulative inventories of

sentence types heard by parents during the first few months of syntactical development after the emergence of two-word constructs in the spontaneous speech of the child. This sampling appears to be catch-as-catch-can, being neither systematic nor thorough, but it was enough to advance the first hypothesis concerning the form of emerging syntax.

3.01 Language sample: Andrew; 19-24 months (Braine 1963)

Pivot Initial Constructions

NO BED	MORE CAR	ALL BROKE	I SEE	OTHER BIB
NO DOWN	MORE CEREAL	ALL BUTTONED	I SHUT	OTHER BREAD
NO FIX	MORE COOKIE	ALL CLEAN	I SIT	OTHER MILK
NO HOME	MORE FISH	ALL DONE		OTHER PANTS
NO MAMA	MORE HIGH	ALL DRESSED	SEE BABY	OTHER PART
NO PEE	MORE HOT	ALL DRY	SEE PRETTY	OTHER PIECE
NO PLUG	MORE JUICE	ALL FIX	SEE TRAIN	OTHER POCKET
NO WATER	MORE READ	ALL GONE		OTHER SHIRT
NO WET	MORE SING	ALL MESSY		OTHER SHOE
NO MORE	MORE TOAST	ALL SHUT	HI CALICO	OTHER SIDE
	MORE WALK	ALL THROUGH	HI MAMA	
		ALL WET	HI PAPA	

Pivot Final Constructions

CLOCK ON THERE	FALL DOWN THERE	BOOT OFF	AIRPLANE BY
UP ON THERE	KITTY DOWN THERE	LIGHT OFF	SIREN BY
HOT IN THERE	SIT DOWN THERE	PANTS OFF	
LIGHT UP THERE	COVER DOWN THERE	SHIRT OFF	MAIL COME
MILK IN THERE	MORE DOWN THERE	SHOE OFF	MAMA COME
		WATER OFF	

Combinatorial Counterexamples

AIRPLANE ALL GONE	BYEBYE BACK	OFF BIB	MAIL MAN
CALICO ALL GONE	BYEBYE CALICO	OUR CAR	MAIL CAR
CALICO ALL DONE	BYEBYE CAR	OUR DOOR	PANTS CHANGE
SALT ALL SHUT	BYEBYE PAPA	LOOK AT THIS	DRY PANTS
		WHAT'S THIS	
ALL DONE MILK	CALICO BYEBYE	WHAT'S THAT	
ALL DONE NOW	PAPA BYEBYE	PAPA AWAY	
ALL GONE JUICE		DOWN THERE	
ALL GONE OUTSIDE	OUTSIDE MORE	OTHER COVER DOWN THERE	
ALL GONE PACIFIER		UP ON THERE SOME MORE	

A pivot grammar is the most complete use of an autonomous syntax. No semantic distinctions are made in the analysis of data, so that only the distributional evidence is considered.

3.02 A pivot grammar

Lexicon

P1 : ALL , MORE , OTHER , NO , I , SEE , HI

P2 : ON THERE , IN THERE , UP THERE , DOWN THERE , OFF , BY , COME

X : BROKE , BUTTONED , CLEAN , DONE , DRESSED , DRY , FIX , GONE , MESSY , SHUT , THROUGH , WET , CAR , CEREAL , COOKIE , FISH , HIGH , HOT , ... , BOOT , LIGHT , PANTS , SHIRT , SHOE , WATER , AIRPLANE , SIREN , MAIL , MAMA , MORE

Syntax

S1 S → P1 X

S2 S → X P2

The pivotal form of grammar seems direct and not unreasonable as children might make such structural distinctions in the early stages of language learning. Braine's unsystematic manner of collecting and presenting the data makes it difficult to offer other, more complete analyses or to explicitly state the criteria for postulating the rules of syntax. Apparently from the distribution of the BYEBYE sentences, some quantitative measure is necessary to determine if a pivot should be

classified as initial or final. Similarly, there is no evident rationale why BY and COME are pivots on the basis of two examples and yet OUR is not acceptable as an initial pivot. Although the single word holophrases are obviously excluded from the data, they are cited as the reason that MORE is entered as both a pivot and an X-class member; while other words like ALL do not occur as single-word utterances.

More to his credit, Braine does mention one important criterion for deciding whether utterances with infrequent words should be classed as pivotal-- subsequent development. It may be noted that the sentences in 3.01 were collected over a five month period and analyzed as a single sample. This is known as the method of synchronic analysis by which sentences occuring at different times are grouped together with the assumption that a single grammar is to account for them all. Admittedly, a five month period is not a very sensitive time sampling as considerable acquisition may have occurred during this period, changing the grammar needed to account for all these sentences. The notion that subsequent development is a criterion by which an earlier synchronic analysis may be evaluated with respect to a later synchronic sample is an important piece of methodology in the absence of a diachronic learning theory. This has been the basic manner in which most formal treatments of child language seek to represent the progress of language acquisition. There is one time period of an early grammar followed by a later time period when a different grammar is in effect. It seems unfortunate that Braine never presented his subsequent data by which it known that COME is a pivot and MAIL is a member of the open X-class. It is possible, however, to follow Andrew's development into a subsequent synchronic sample where

Braine (1965) offers a context-free phrase structure as the developmental derivative of the pivotal syntax.

The studies of Lois Bloom (1970) provided the formal introduction of phrase structure grammar for the emergent syntax in the two-word period immediately following the holophrase stage of development. She claimed that simple binary structure of the pivot grammar was inadequate for the first two-word syntax because of major differences in the meaning of these utterances. A taxonomic classification of a child's two-word meanings was given in the manner of structural semantics, and a larger generative syntax was then required.

Bloom's data samples were collected by tape recording some play sessions with a child and closely transcribing every utterance with as much pragmatical context as needed to be certain of the intended meaning of each utterance. Rather than presenting all of her transcript data, however, she selected utterances to illustrate the discussion of her analytic methods. The language sample which follows are all of the sentence types from her child, Kathryn, which Bloom selected from 1225 child utterances in $7\frac{1}{2}$ hours of recorded conversation.

3.03 Language sample: Kathryn; 21 months 0 weeks (Bloom 1970)

Attentive Pivots	Demonstrative Pivots		Nonexistence Pivots
HI SPOON	THIS NECKLACE	THIS BUTTON	NO POCKET
HI SHADOW	THIS RIDES	THIS SOCK	NO POCKET IN THERE
HI HONKY DORY	THIS BABY BOOK	THIS DIRTY	NO SOCK
HI CHILDREN	THIS TURN	THIS FUZZY	NO FIT
HELLO CHILDREN	THAT'S TURN	THIS WINDOW	NO ZIP
OH BABY	THIS SLIPPER	THIS CLEANING	NO TURN
THANK YOU BEAR	THIS BOOK	THAT'S COLD	NO CLOSE
OK LAMB	THIS HAND NOW		NO WINDOW
OK RAISIN			ə NO

Recurrence Pivots

MORE CEREAL
MORE RUBBER BAND
MORE TOY
MORE SO-- CEREAL
MORE HAIR CURL
MORE MEAT
MORE COTTAGE CHEESE
ə MORE MILK
MORE MILK
MORE NUTS
ə MORE NUTS

MORE RAISIN
MORE RAISIN MORE
ə MORE RAISIN
ə wə MORE RAISIN
MORE HAND
MORE SOAP

NOTHER BLOCK
NOTHER TOY
NOTHER HAIR CURL
NOTHER PIN

Rejective Pivots

NO DIRTY SOAP
ə NO CHAIR
NO SOCK

Denial Pivot

NO DIRTY

Genitive

MOMMY SOCK
MOMMY SLIPPER
MOMMY HAIR CURL
KATHRYN SOCK
KATHRYN SHOES
MOMMY'S MILK
SHEEP EAR
ə TIGER TAIL
TIGER TAIL

Subject-Objective

MOMMY SOCK
MOMMY PIGTAIL
MOMMY ə MORE HAND
MOMMY SHOE
MOMMY ə MUFFIN MAN
MOMMY VEGETABLE
MOMMY æ MORE MEAT
BABY MILK

KATHRYN ə BEAR
JOCELYN CHEEK
/α/ BABY CHEEK
BABY COTTAGE CHEESE
WENDY COTTAGE CHEESE
CAT COTTAGE CHEESE
CAT MEAT
CAT MORE MILK

Agent-Active

MOMMY BUSY
MOMMY PUSH
MOMMY PULL
MOMMY BOUNCE
LOIS COMING
BABY BUSY
BABY STRETCH
LOIS ə COMING

Predicate

TOUCH MILK
HELPING MOMMY
ATE NUTS
THROW MEAT
LIE DOWN TABLE
ə TAKE ə NAP
ə PULL HAT
ə SEE BALL
ə TRY
ə PULL

Attributive

JEWELRY PIN
PARTY HAT
BREAD BOOK
COFFEE CAKE
COFFEE NOODLES

Subject-Locative

SWEATER CHAIR
WENDY ELEVATOR
BEANBAG HORSE

Noun Phrase

TWO WINDOW
TWO SHEEP
BLACK HAIR
ə BOOK
ə^{n} SOFA
ə^{n} TIRE
də DIRTY

Equivocal Ambiguities

MOMMY APPLE
MOMMY COTTAGE CHEESE
MOMMY MILK
MOMMY HANGNAIL
MOMMY VEGETABLE
MOMMY SHADOW
MOMMY IRON
MOMMY KISS
LOIS KISS

WENDY HAIR
KATHRYN APPETITE
WENDY BOOK
BEAR RAISIN
BABY RAISIN
KATHRYN RAISIN
KATHRYN ə RAISIN
OH KATHRYN RAISIN

Conjunctive

UMBRELLA BOOT
FOOTS FLOWER
'CHINE FOOT
GIRL DRESS
GRANDMA FLOWER
LOIS TOY

Counterexamples

I COMB PIGTAIL	BABY DO IT	KATHRYN HAS THAT BOOK
'CHINE MAKE NOISE	I'M BUSY NOW	MAN RIDE ə BUS
ME SHOW MOMMY	TWO SIT DOWN	MOMMY THROW IT AWAY
KATHRYN WANT RAISIN	WHERE THE SPIDER	MAKE HIM SIT DOWN
KATHRYN WANT PUDDING	HELPING SQUISH	WHO HAS THAT BOOK
SHEEP ə FUZZY	MOMMY SHIRTS HOT	DOLLY EYE PRETTY EYE
MOMMY DO IT	ə WANTA SEE	ə WANTA SIT DOWN CHAIR
	TWO SHEEP SIT DOWN	

Bloom's grammar, 3.03 presented below with simplified lexical entry rules, generates very large phrase structures to correspond to meaning categories: genitive; subject-objective; attributive; and so forth. An obligatory reduction transformation is defined upon any structure larger than binary so that any operation of this reduction can recursively prune any size initial phrase structure in a derivation to a two-word surface string. The factorization for this reduction uses the greek letter meta-variables in its structural description without specifying any necessary structural content although its operation is intended to be constrained in some manner to strings with three or more constituents. The phonetic symbol, ə , schwa, is a meaningless constituent which holds phrase-initial position on any kind of phrase structure.

3.03 A transformational phrase structure grammar

Lexicon

Noun : APPETITE , APPLE , BABY , BALL , BALLS , BEANBAG ,
BEAR , BLOCK , BOOK , BOOT , BOY , BUTTON , CAR ,
CAKE , CARROT , CAT , PUSSYCAT , CEREAL , CHEEK ,
CHICKEN , CHILDREN , 'CHINE , COTTAGE CHEESE , ... ,
RUBBER BAND , SHADOW , SHEEP , SHIRTS , SHOE ,
SHOVEL , SLIPPER , SOAP , SPOON , SPIDER , SWEATER ,

TAIL , TAPE , TIGER , TOE , TOENAIL , TOY ,
UMBRELLA , VEGETABLE , WATCH , WALL , WENDY ,
WINDOW

Verb : ATE , AWAY , BOUNCE , BUSY , CATCH , CLEANING ,
CLOSE , COMB , COMING , COUGH , DANCE , DO ,
FIND , FIT , GET , GO , HAVE , HELP , HELPING ,
HERE , HURT , IN , IRON , ... , RIDE , RIDING ,
SEE , SIT DOWN , STRETCH , STUCK , SHOW ,
SQUISH , THROW , TOUCH , TURN , WANT , WASH ,
WATCH , ZIP

Adjective : ALL , BABY , BIG , BREAD , COFFEE , COLD , DIRTY ,
FUNNY , FUZZY , HEAVY , JEWELRY , LITTLE , MORE ,
NOTHER , PARTY , PINK , SHARP , STICKY , TIRE ,
TWO

Syntax of Phrase Structure

S1 S → NOM VP

S2 S → NOM NP

S3 S → NOM NG VP

S4 S → NOM NG NP

S5 S → PIVOT N

S6 NOM → DEM

S7 NOM → N

S8 VP → VB

S9 VP → VB NP

S10 VP → VB PART

S11 NP → N

S12 NP → ə N

S13 NP → ə ADJ N

S14 NP → ADJ N

S15 PIVOT → HI , OH , OK , THANK YOU

S16 N → PRON

S17 N → PREP

S18 N → APPETITE , APPLE , BABY , BOOK , ...

S19 DEM → THIS , THAT , THAT'S

S20 VB → ATE , AWAY , BOUNCE , BUSY , ...

S21 NG → NO

S22 PART → NOW , HERE , OUTSIDE , AWAY , LATER , RIGHT

S23 PRON → I , IT

S24 PREP → ON , OFF , UP

S25 ADJ → ALL , BABY , BIG , BREAD , ...

Syntax of Transformational Rules

TF1 Optional Adjective Placement

Factor :	α	ADJ	N	β
Copy :	α	ADJ	N ADJ	β
Delete :	α		N ADJ	β

TF2 Optional Preposition Placement

Factor :	α	PREP	N	β
Copy :	α	PREP	N PREP	β
Delete :	α		N PREP	β

TF3 Optional Schwa Placement

Factor : $\alpha \vdots \underline{VP} \vdots \beta$

Add : $\alpha \vdots \underset{\sim}{\text{ə}}\ \underline{VP} \vdots \beta$

TF4 Obligatory Prenegative Reduction

Factor : $\alpha \vdots \underline{NG} \vdots \beta$

Delete : $\underline{NG} \vdots \beta$

TF5 Obligatory Phrase Reduction

Factor : $\alpha \vdots \beta \vdots \gamma$

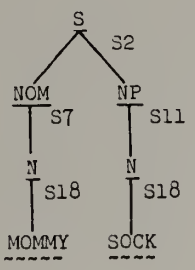
Delete : $\alpha \vdots \gamma$

This obligatory reduction at the end of the grammar is such a powerful device that its operation characterizes most the derivational process of this grammar. Its formulation is doubtful, since it violates the metalinguistic criterion of recoverability which is necessary for meaning preserving transformations and hence it cannot be aquirable as an inherent property of the language acquisition device. Furthermore, such a rule could not be learnable like the other rules from the primary evidence of mother's language since this rule is not part of the adult's grammar. If the obligatory application of this reduction were strictly adhered to, all single word utterances would filtered and all utterances of more than two words would be counterexamples to this formal treatment. Bloom, however, is somewhat lenient in her classifications.

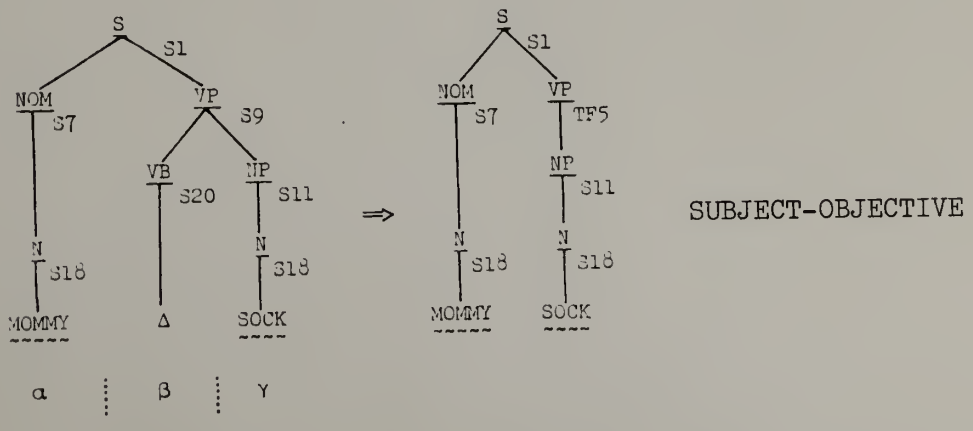
The taxonomic classifications of structural semantics do not have explicit principles which relates the semantical categories of meanings to the syntactical derivation process. Bloom claims to rely upon some

unformulizable intuitions of pragmatical or extralinguistic contexts to obtain the semantical interpretation of this syntax. Unintuitive situations result in the rather numerous examples of equivocal ambiguities which are thought to be mostly genitive or subject-objective. In the 3.04 analysis trees, a configurational assignment is given for Bloom's interpretive categories to initial phrase structures. The greek letter, Δ , is known as the delta dummy-- evidently being an unspecified lexical entry. As an odd feature of incomplete interpretive analysis, Bloom does not provide the rule for the double-noun noun phrase for her conjunctive interpretation, but she does suggest something like it in her discussion of the grammar.

3.04 Analysis trees and corresponding semantical categories

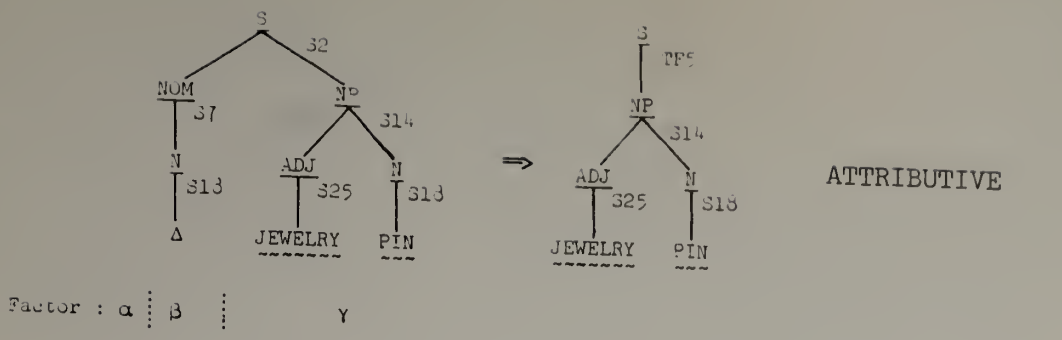


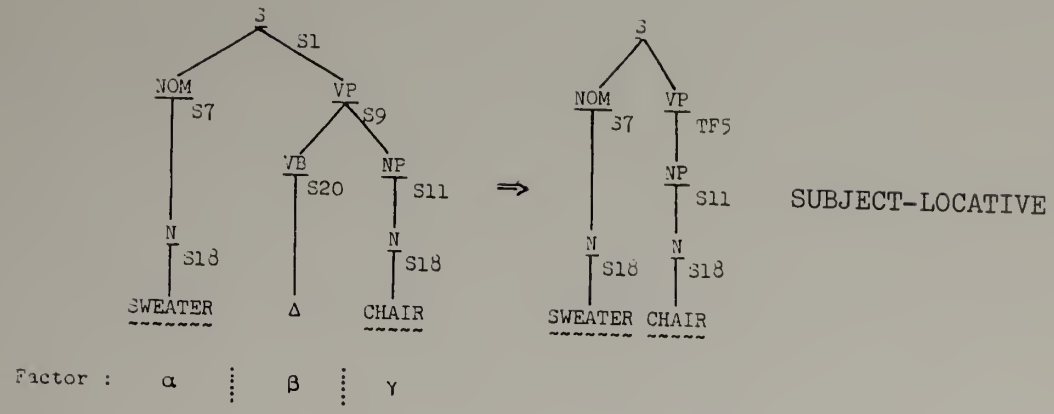
GENITIVE

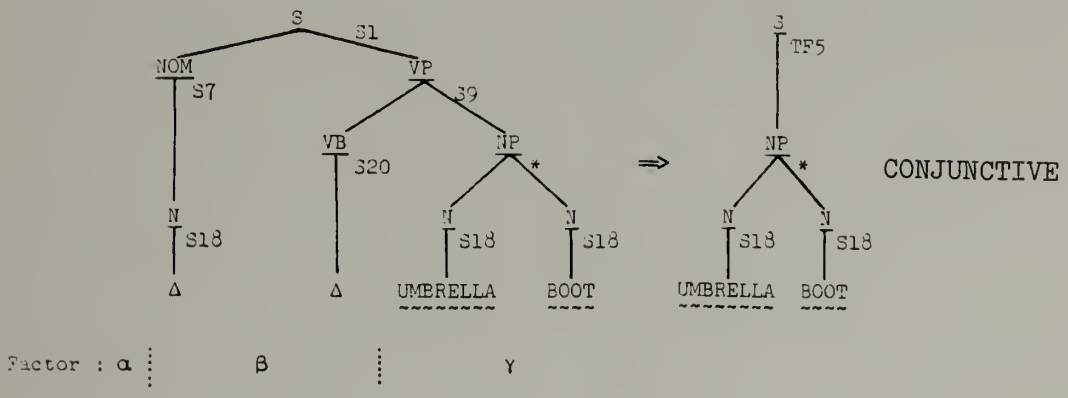


SUBJECT-OBJECTIVE

Factor : α ⋮ β ⋮ γ







Bloom's thesis is a clear advance in formal treatment of early child language over the pivot grammar of Braine. Most researchers since have either applied some portion of her treatment-- usually the context-free phrase structure, or have muddled up the formalisms-- most often laboring over the confusion between semantics and pragmatics but sometime

even the distinction between performance and competence is lost. To be certain, these are not simple matters especially when first encountered with intellectual instruments which were sharp by earlier standards but seem blunt when encountering new phenomena needing improved methods. The search of syntax for semantics has not been simple nor at times straightforward, but a complete semantics is presently available which can parallel the accomplishments of syntax stride by stride. It is the purpose of the remainder of this section to introduce a formal improvement in descriptive method for early child language that is at least as important as the one described above. In that these improvements mostly concern the degree of explicit description in the semantical component, and the grammars, lacking a formal pragmatics, are still incomplete; it is reasonable to anticipate a time when these theories shall be laid to rest by better ones closer to completeness.

3.1 Child language samples are almost always pleasant to collect. Especially in the earliest stages of development, a child's language is one of the simplest forms of psychological performance. Being much simpler than the adult language, there is hope of more adequate description by fewer grammatical devices and fewer theoretical uncertainties. It may be possible to offer a formal analysis for all of a child's performance capacities before it is possible to do so for the more complex performances of an adult. The child's first words are undeniable mental events, and by their nature to communicate something, they are subject to a high degree of observer certainty. A person who is familiar enough with a child to converse with it should be able to specify what has been communicated. One of the most natural forms of data is the verbatim

transcript of the child's most usual social conversation. The obvious limitations of spontaneous productive performances in underestimating the first acquisition of learned abilities is not at empirical risk here. The construction of controlled elicitation techniques follow descriptive methods in relatively untampered environments where the counterexamples can be observed.

This study concerns the language of a young girl, Shannon, when she was twenty-three months old. An hour length transcript was prepared with as little interruption of her normal comings and goings as possible. The corpus of transcripts begins during her fourteenth month and continues weekly with measured hour samples taken at times convenient for Shannon. For much of the first nine months of holophrastic speech, tape recorded samples were infrequent and not substantially different from direct observational transcripts written as the words were spoken. Her earliest two-word utterances were rather isolated examples in otherwise single word performances. The transcript fragments from the twenty-third corpus entry on 21 August 1976 and from the twenty-fifth sample on 23 September 1976 provide good illustration of these earliest combinational tokens. Henceforth, observational transcripts can be recognized by time markers which progress minute by minute identifying the temporal period in which the ordered sequence of utterances occurred. Recorded transcripts of 60-minute casettes usually contain more complete verbal context and lack the time markers.

3.10 Transcript fragments: Shannon

TRANSCRIPT, Observationnt
20 Months 20 days old
21 August 1976

1205PM	ICE	
1206	ICE	Sh. hands cup to Stan
		Stan: More ice?
	ICE	
	ICE	
	ICE	
	ICE	
	ICE	
		Stan: Want more ice?
	ICE	
	ICE	
	ICE	
	ICE	
	ICE	
	ICE	Sh. points to refrigerator
1207		Mother gives Sh. more ice from the freezer
1208		Stan: More ice?
	MORE ICE	
	ICE	

TRANSCRIPT, Recorded
21 months 22 days old
23 September 1976

...	RING	Sh. points to Stan's puzzle ring
	RING	
		Stan: Ring?
	RING	
		Ring?
	RING	
		We'll-- ah--
		We'll ought not to give you that one
	RING	
		It falls apart
		and I'm not sure
		if I can get it back together again
	RING	
		Eh, let's see what happens
		Ring?
	RING	
		Stan gives the ring to Sh.
		Puzzle ring disintegrates
	/A-- A-- A WING/	(with surprise)
		Stan: What's this?
		Doesn't look like a ring anymore, does it?
		Dada ring? (Suggesting Sh. give it to father)
	DADA RING	
		Yea?
	DADA RING	
		Sh. returns ring to Stan
		Stan: I was afraid this was going to happen
		You know how to do these rings?
		Father: No

Two-word constructs of this nature began to more frequently occur. In the twenty-seventh transcript, about a third of Shannon's utterances were two-worded. The twenty-eighth sample was taken on 27 October 1976 when she was 22 months 26 days old; and this transcript was the earliest point in the corpus where half of her conversation was constructed in syntactic phrases (MLU: 1.5). Coincidently, it is also the earliest point where three-word constructs were sampled and also the first clear performance breaking of phrase structure is evident. This 28th sample is the data base for synchronic analysis of Shannon's earliest syntactic structures and what is understood to be their meanings. It should be mentioned that all of the two-word constructs sampled before this date conform to the output of this grammar of this sample-- merely being less frequent during the previous six weeks.

This Shannon 22 mo 26 da transcript (Appendix A) is available at the end of this study so that anyone may consider the raw data of the analysis and ascertain for themselves the accuracy of the fit between grammar and what was actually said. It is unfortunate that so few child language studies in the past have reported complete sets of their fundmental data rather than the usual practice of selecting whatever examples appear to support the researcher's analysis. It is important to play the game with all of the cards on the table, especially the ones which do not seem to help the strategy. The counterexamples to a theory are often a persistent source of subsequent theories and deserve the respect of attention.

The 3.11 language sample is a strict collection of every utterance spoken by Shannon during a measured hour. Almost everything she said could be clearly interpreted for its truthfulness because Shannon was

carefully articulate and she enjoyed conversation with familiar adults. The adults who spoke with her had long understood her holophrastic words to have some propositional qualities which permitted sequential conversation about a situation. By the time of this sample, the two- and three-word sentences were understood with a compositional semantics. The 3.11 sample is organized so that each sentence token in the transcript is cummulatively categorized as a sentence type according to its structure and meaning. All of the pragmatical features of the conversation are left in the transcript except questioning and the holophrastic negative answering. Even at this stage of early acquisition, the meaning of an utterance and how it was to be interpreted is not crucially reliant upon pragmatical information. There may continue to be some confusion about this for some time until better grammars with formal pragmatical components are available.

Every word in the sample has been transcribed to the recognizable level of inflectional morphology; although, morphology is not part of the analysis. Most of these inflections in Shannon's vocabulary were inconsistent-- sometimes used with apparent meaningful application; sometimes omitted when they were appropriate; and sometimes used when inapplicable. Inflectional forms of what may seem to be a common root or lexical stem are here treated as separate, sometimes alternative vocabulary entries. It is curious that the genitive inflection upon a holophrastic term always appeared to retain a distinct genitive meaning; therefore, these are accepted as counterexamples to the nonmorphology aspect of this analysis. The intonational contour of holophrastic questioning also maintained a constant conversational function. There are

22 utterances that have been dropped from the 3.11 sample because of some unintelligibility in their performance. The location of these in the discourse and some level of phonic approximation of the unintelligible portions may be found in the appendix. The accuracy of the observational form of transcript was reliable and certain to the three adults who spoke with her the most. This language sample was collected under the most customary of sampling situations-- in Shannon's home with her mother doing some chores and sometimes playing with the toys; researcher following around with pocket watch and clipboard.

One-Word Utterances

Terms		Common Nouns		Questioned Terms	
BELINDA	7	BIKE	8	BELINDA?	3
BABY	17	BANANA	5	STAN?	1
STAN	3	JUICE	8	MOMMY?	7
MOMMY	5	GLASS	1	DADDY?	1
SHANNON	1	PUMPKIN	1	ANGELA?	5
DOGGIE	19	CEREAL	10		
MAMA	2	TEA	4	Questioned CNs	
ANGELA	10	LEASH	2		
MY	1	BOTTOM	3	BANANA?	1
BABIES	2	FECES	18	JUICE?	1
		PIN	1	PIN?	1
		DAY	1		
		NIGHT	3		

Term Properties		CN Properties		Negative Element	
UP	17	SHARP		NO	2
WASH	6	HOT			
HI	7	UH-OH			

Categorical Counterexamples

DADDY'S	2	THERE	1
MOMMY'S	1	ON	1

Two-Word Utterances

Genitive		Questioned Genitive		Rejective Negation	
DADDY'S SHOES	8	STAN BANANA?	1	NO BANANA	3
MOMMY'S SHOES	4	MAMA PIN?	1	NO BREAD	1
SHANNON'S SHOES	3	MAMA TEA?	4	NO CEREAL	3
BELINDA JUICE	1	SHEILA SPOON?	1	NO NUTS	11
BABY HEAD	1	STAN TEA?	1	NO JUICE	1
BABY PUMPKIN	4	BABY COFFEE?	1		
MY CEREAL	3	BABY BREAST?	3		
SHANNON PINS	3	BABY SHOES?	1		
MAMA PIN	5				
STAN TEA	4				
MAMA'S CEREAL	1				
STAN SPOON	2				
MAMA MATCHES	10				
STAN MATCHES	1				
MAMA COFFEE	17				
MAMA TEA	1				
STAN TEA	10				
STAN BREAST	7				
SHANNON COFFEE	2				
SHANNON BREAST	3				
STAN COFFEE	1				

Relational Genitive		Denial Negation	
MAMA HOT	4	NO WET	8

Term Specification		Common Noun Specification		Combinatorial Counterexamples	
BYEBYE STAN	1	UH-OH LID	2	BABY BARBARA	1
UP MOMMY	5	UH-OH JUICE	6	BABY ALICE	1
UP MAMA	1	UH-OH BIKE	1	TWO BABIES	5
		BIG PUMPKIN	5	BABY RUG	2
				SOCK ON	5
				BELT ON	8
				WASH BOTTOM	3
				A BOTTOM	5
				FIND TEA	3
				A TEA	1

Three-Word Utterances

Combinatorial Counterexamples

NO MORE JUICE	1
BELT ON BIKE	3

3.11 Language sample: Shannon; 22 mo 26 da

CATEGORIZATION OF ALL INTELLIGIBLE UTTERANCES AND FREQUENCIES OF THEIR OCCURRENCE IN SAMPLE 27 OCTOBER 1976.

3.2 Grammatical analysis of child language sample

3.20 Grammar: Shannon; 22 mo 26 da

Lexicon of Basic Expressions

Sentence	:	t	:
Terms	:	e	: MAMA , MOMMY , SHANNON , DADA , ...
Common Nouns	:	t//e	: BIKE , TEA , BREAST , BOTTOM , ...
Term Properties	:	t/e	: BYE-BYE , UP , WASH , HI , ...
CN Properties	:	t/(t//e)	: UH-OH , BIG , HOT , SHARP , ...
Neg Element	:	t/t	: NO

Syntax of Phrase Structure					Example
S1	t	→	e	t//e	DADDY'S SHOES
S2	t	→	t/e	e	BYE-BYE STAN
S3	t	→	t/(t//e)	t//e	UH-OH LID
S4	t	→	t/t	t//e	NO BANANA
S5	t//e	→	t/(t//e)		[t//e HOT t//e]
S6	t	→	t ?		BELINDA?
S7	t	→	e		MAMA
S8	t	→	t//e		BIKE
S9	t	→	t/e		BYE-BYE
S10	t	→	t/(t//e)		UH-OH
S11	t	→	t/t		NO
S12	e	→	MAMA , MOMMY , SHANNON , DADA , DADDY , MY , STAN , BABY , ...		

S13	t//e	→	BIKE , TEA , BREAST , BOTTOM , ...
S14	t/e	→	BYE-BYE , UP , WASH , HI , ...
S15	t/(t//e)	→	UH-OH , BIG , HOT , SHARP , ...
S16	t/t	→	NO

	Semantics of Logical Translation[4]	Example Symbolization
T1	$\forall z \forall u\,[\beta(\hat{}u) \wedge u = \alpha]$	$\forall z \forall u\,[\mathrm{SHOES}'(\hat{}u) \wedge u = \mathrm{DADA}']$
T2	$\forall u\,[\gamma(\hat{}u) \wedge u = \alpha]$	$\forall u\,[\mathrm{BYE\text{-}BYE}'(\hat{}u) \wedge u = \mathrm{STAN}']$
T3	$\forall z \forall u\,[\beta(\hat{}u) \wedge \delta(\hat{}z)]$	$\forall z \forall u\,[\mathrm{LID}'(\hat{}u) \wedge \mathrm{UH\text{-}OH}'(\hat{}z)]$
T4	$\forall z \forall u\,[\beta(\hat{}u) \wedge \zeta\, u = u_n]$	$\forall z \forall u\,[\mathrm{BANANA}'(\hat{}u) \wedge \neg\, u = u_1]$
T5	$\lambda x\,[z(x) \wedge \delta(\hat{}z)]$	$\lambda x\,[z(x) \wedge \mathrm{HOT}'(\hat{}z)]$
T6	$?\,[\varphi]$	$?\,[\forall u\,[u = \mathrm{BELINDA}']$
T7	$\forall u\,[u = \alpha]$	$\forall u\,[u = \mathrm{MAMA}']$
T8	$\forall u\,[\beta(\hat{}u)]$	$\forall u\,[\mathrm{BIKE}'(\hat{}u)]$
T9	$\forall u\,[\gamma(\hat{}u)]$	$\forall u\,[\mathrm{BYE\text{-}BYE}'(\hat{}u)]$
T10	$\forall z \forall u\,[z(\hat{}u) \wedge \delta(\hat{}z)]$	$\forall z \forall u\,[z(\hat{}u) \wedge \mathrm{UH\text{-}OH}'(\hat{}z)]$
T11	$\forall u_m\,[\varphi'' \wedge \zeta\, u_m = u_n]$	$\forall u_2\,[\mathrm{SOUP}''(\hat{}u_2) \wedge \neg\, u_2 = u_1]$

where φ' is part of the presuppositional common ground and φ'' is the result of replacing all occurrences of a single nonindexed variable in φ' with u_m .

T12 MAMA' , MAMA' , SHANNON' , DADA' , DADA' , SHANNON' , STAN' , BABY_n' , ...

---

[4] The greek letter metavariables are here used in place of the categorial definitions. This avoids the problem of marking the parentheses for disambiguating the slash notation. Following the order in the lexicon, phi is reserved for the type of sentences, alpha for terms, beta for common nouns, and so forth.

T13 BIKE' , TEA' , BREAST' , BOTTOM' , ...

T14 BYE-BYE' , UP' , WASH' , HI' , ...

T15 UH-OH' , BIG' , HOT' , SHARP' , ...

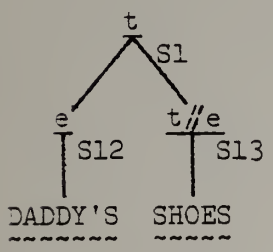
T16 $\lambda P\,[\neg P]$

For discussion in the following text, names are given to each syntactical-semantical rule pair: (S1-T1) genitive; (S2-T2) term specification; (S3-T3) common noun specification; (S4-T4) rejective negation; (S5-T5) common noun property conversion; (S6-T6) question; (S7-T7) thru (S11-T11) are holophrase rules; and (S12-T12) thru (S16-T16) are lexical entry rules.

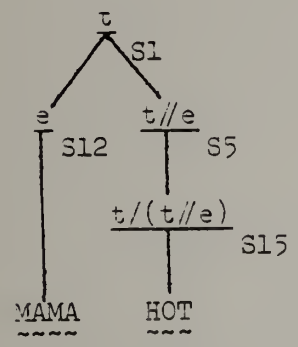
Comparing this grammar with the two presented in the previous section, there are a number of advantages with this form of analysis with respect to early child language. The explicit compositional nature of the semantical treatment is an improvement over the structural taxonomy available to Bloom's work. Formal consistency in meaningful interpretation is a good replacement for unspecifiable judgements based upon the pragmatical or extralinguistic contexts and Shannon is remarkably consistent in her earliest combinatorial abilities. An autonomous semantics is an ideal companion for the autonomous syntax in generative grammars. The simplicity of the binary syntax for the first word constructions is regained since the compositional semantics can do its own work, albeit with substantial aid from the translation into logic. Another advantage of the 3.20 grammar is the uniformity of the rules which generate the greater range of the child's early forms. That powerful and obligatory reduction at the end of Bloom's grammar is unnecessary and neither is

the claim for mysterious performance limitations which sometime sustain three-word utterances but at other times can only muster a holophrase. All performance counting-- like MLU or the one-, two-, and three-word division in the 3.11 sample-- is extraneous to the analysis of mental competence. Grammars are just not organized by the number of words or the length of sentences they are used for in performance. The intensionality of the logic in 3.20 is an attractive feature as it may supply some unexpected motivation for the acquisition of binary syntax over the conversationally powerful holophrase.

3.21 Genitive constructs: analysis trees and derivations



i.	φ	exponent
ii.	$\forall\underline{z}\forall\underline{u}\,[\beta(\hat{}\underline{u}) \wedge \underline{u} = \alpha]$	by T1
iii.	$\forall\underline{z}\forall\underline{u}\,[\beta(\hat{}\underline{u}) \wedge \underline{u} = \underline{\text{DADDY'S}}']$	by T12
iv.	$\forall\underline{z}\forall\underline{u}\,[\underline{\text{SHOES}}'(\hat{}\underline{u}) \wedge \underline{u} = \underline{\text{DADDY'S}}']$	by T13



i.	φ	exponent
ii.	$\forall\underline{z}\forall\underline{u}\,[\beta(\hat{}\underline{u}) \wedge \underline{u} = \alpha]$	by T1
iii.	$\forall\underline{z}\forall\underline{u}\,[\lambda\underline{x}\,[\underline{z}(\underline{x}) \wedge \delta(\hat{}\underline{z})](\hat{}\underline{u}) \wedge \underline{u} = \alpha]$	by T5
	$\forall\underline{z}\forall\underline{u}\,[\underline{z}(\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z}) \wedge \underline{u} = \alpha]$	λ-convert
iv.	$\forall\underline{z}\forall\underline{u}\,[\underline{z}(\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z}) \wedge \underline{u} = \underline{\text{MAMA}}']$	by T12
v.	$\forall\underline{z}\forall\underline{u}\,[\underline{z}(\hat{}\underline{u}) \wedge \underline{\text{HOT}}'(\hat{}\underline{z}) \wedge \underline{u} = \underline{\text{MAMA}}']$	by T15

The genitive relationship between an individual and an object is one of the earliest grammatical distinctions that Shannon made in learning how to construct larger meanings with smaller parts. She had learned

to express an asymmetrical functional relation by joining words into phrases: an individual could possess a common noun and not the reverse. The adults who spoke with her understood this relationship to be something like possession, at least. There were a number of different situations in which this relationship could be asserted: (i) sometime an individual was in proximity of an object, as in BABY BREAST or in ELEPHANT BIKE; (ii) sometime an object might have distinguishable properties which could identify its possessor even in the absense of that person, as in DADDY'S SHOES which were usually larger or elsewhere MOMMY'S CAR which was known to be the green Fiat; and, (iii) sometime an object could simply be ascribed to someone, as SHANNON PLATE which looked just like the others or STAN COFFEE which referred to a nonactual cup of coffee-- Stan only drinks tea. It is not an important semantical matter that these pragmatical situations differed from each other. When Shannon was ascribing a basic genitive relationship between individuals and objects, she could be understood by her parents in doing so no matter how untrue such ascriptions might be to the actual circumstances. This semantical distinction between individuals and objects is the consistent basis for the syntactical categories of term and common noun. Her very consistent distinction between term and common noun is reflected in that properties of individuals (BYE-BYE , UP) are not asserted of common nouns or vicaversa.

There is a primary semantical problem in the set of possible individuals denoted by term expressions in that they do not seem to correspond to any natural kind. The most obvious set members are people who engage in conversation or play with her. MAMA , MOMMY , DADA , DADDY

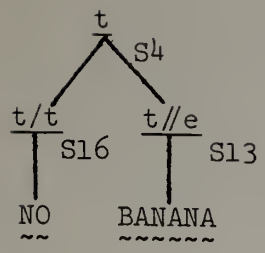
were term expressions which semantically functioned as rigid designators for the two specific individuals. At some point in the future Shannon will have to reanalyze these terms into common nouns when she learns to refer to Vera's mother, Matthew's mother, and others. BELINDA , STAN , SHANNON are terms to designate certain individuals and shall remain so. BABY and DOGGIE are terms which do not function semantically in the proper individuating manner as they can refer to any particular individual of a specified subset of the individuals. BABY can be used to designate any of the dolls, some plastic figurines, child-like individuals within drawings or photographs, and her two teddy bears. Most of these individuals had no other designation at this time. In particular, naming of her dolls was months in the future. DOGGIE is a function which picks out any canine individual, including two Irish setters who were the family pets: named BRANDY and GARTH . Clearly, the syntactical category of term contains some expressions which seem like terms and some which seem like common nouns at the level of their semantical function. Shannon's subsequent development will be faced with some reanalysis with respect to this category. Bloom's sample of Kathryn, 3.03, suggests a similar treatment, although this distributional distinction was missed in structural semantics for her study. Braine's 3.01 sample does not suggest much for the term distinction. This may be result of the selective reporting or the catch-as-catch-can sampling, or it may indicate some of the acquisitional variablity observed between children during this early phase of emergent syntax and semantics.

The second example in 3.21, MAMA HOT , is known as a relational genitive and it is of interest because of the lambda-abstraction in its

derivation. Since MAMA HOT means that mother has something which is hot, the semantical rules require the lambda-abstract in S5-T5 for the common noun entailment. As may be noted from the transcript (or 3.20 below), this utterance should not be interpreted that mother is hot-- such an attribution would be noncategorial, given the definition of common noun property-- and it is a proper semantical entailment that HOT is an attribute of some noun-like thing related to MAMA . The semantical translation, T5 , supplies the additional entailment by conjoining two well-formed propositions with a shared z-variable, eg. $\lambda x\ [z(\hat{}u) \wedge HOT'(\hat{}z)]$. All previous treatments of early child language have been problemed by such obvious compressed meaning for which underlying syntactic solutions or covert lexical items failing under performance limitations have been suggested. The use of lambda-abstraction at least supplies a direct compositional derivation with no deletions with the advantage of giving a simpler treatment for negation and some other relational constructs to be seen later.

The noncategoriality of the common noun property conversion rule, S5, is a notable weakness of this syntax in order to provide the entailed semantical meaning and would not be motivated on purely autonomous distributional evidence. As a metalinguistic principle, a purely categorial syntax is preferred because of the explicit manner in which such rules can be functionally related to the semantics. Other rules besides S5 are noncategorial-- such as the lexical entry rules, the holophrase rules, and the rejective negation-- so that Shannon's grammar seems inconsistent with respect to categoriality in some parts, but then her early morphology also exhibits metalevel immaturity of similar sort.

3.22 Negative constructs: analysis trees and derivations



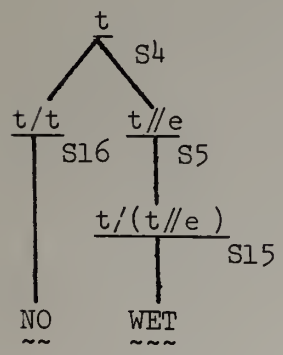
i. φ exponent

ii. $\forall \underline{z} \forall \underline{u} [\beta(\hat{}\underline{u}) \wedge \zeta\, \underline{u} = \underline{u}_1]$ by T4

iii. $\forall \underline{z} \forall \underline{u} [\beta(\hat{}\underline{u}) \wedge \lambda \underline{P} [\neg \underline{P}]\, \underline{u} = \underline{u}_1]$ by T16

$\forall \underline{z} \forall \underline{u} [\beta(\hat{}\underline{u}) \wedge \neg\, \underline{u} = \underline{u}_1]$ λ-convert

iv. $\forall \underline{z} \forall \underline{u} [\underset{\sim\sim\sim\sim\sim\sim}{\text{BANANA}}'(\hat{}\underline{u}) \wedge \neg\, \underline{u} = \underline{u}_1]$ by T13



i. φ exponent

ii. $\forall \underline{z} \forall \underline{u} [\beta(\hat{}\underline{u}) \wedge \zeta\, \underline{u} = \underline{u}_1]$ by T4

iii. $\forall \underline{z} \forall \underline{u} [\lambda \underline{x} [\underline{z}(\underline{x}) \wedge \delta(\hat{}\underline{z})](\hat{}\underline{u}) \wedge \zeta\, \underline{u} = \underline{u}_1]$ by T5

$\forall \underline{z} \forall \underline{u} [\underline{z}(\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z}) \wedge \zeta\, \underline{u} = \underline{u}_1]$ λ-convert

iv. $\forall \underline{z} \forall \underline{u} [\underline{z}(\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z}) \wedge \lambda \underline{P} [\neg \underline{P}]\, \underline{u} = \underline{u}_1]$ by T16

$\forall \underline{z} \forall \underline{u} [\underline{z}(\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z}) \wedge \neg\, \underline{u} = \underline{u}_1]$ λ-convert

v. $\forall \underline{z} \forall \underline{u} [\underline{z}(\hat{}\underline{u}) \wedge \underset{\sim\sim\sim}{\text{WET}}'(\hat{}\underline{z}) \wedge \neg\, \underline{u} = \underline{u}_1]$ by T13

Negation in early syntax is not an easy subject to specify since there is almost universal child interest in the function but many kinds of not. Negation is a simple formal object semantically, but its acquisition in syntax is somewhat complex. There seems to be some acquisitional variation between children, although most develop some form of the negative very early. The negative is an important semantic function to children and it usually preceeds the emergence of some form of affirmative by a very considerable period.

Bloom's child, Kathryn, is said to have three forms of negative in her early syntax: rejection, denial, and nonexistence. In the 3.03 grammar, the negative element is introduced in the phrase structure

rules, S3 and S4, and the obligatory length-reducing transformation, TF4, later in the derivation will selectively retain the negative meanings. The three interpretations for those semantical categories was inferred from observation of the contextual referent. Rejection was interpreted when the referent was present or imminent; denial concerned the inappropriate predication of a referent; and nonexistence was interpreted when an expected referent was not present. The formal relation between syntax and semantics for these interpretations is not clear, as some of the nonexistence interpretations involve nouns while others have verbs-- NO POCKET , NO TURN .

Shannon's early conversational performances provide evidence for more complex restrictions on her use of the negative when compared to Bloom's interpretations of Kathryn. The use of formal semantical correspondence to syntactical structure gives a consistent and compositional treatment for her negatives in combination with the other major categories, but it is substantially different from her holophrastic negation. The 3.22 examples illustrate her early use of the negative in combination with other words. The first clear impression is that rejective negation is strongly associated with the genitive construction. The problems of integrating these two in the grammar gives much of its derivational character.

The logical translations in her semantics makes much interpretive use of variables; u , x , z , P ; which lack any syntactical or morphological correlates. The semantics supplies these non-indexed variables for its own purposes in interpreting the simpler surface syntax and much of the compression effect in meaning is accounted for by these devices.

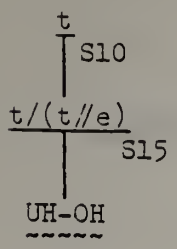
Ignoring for a moment the issues of holophrase interpretation, the u-variables in the genitive translation are largely motivated by the rejection meanings in the negative forms which are so strongly associated with the genitive in the conversational data. Since the t/e common nouns correspond with sets of individual concepts in the semantical component, the simplest formulation of the genitive with this model ontology would be something like: $\beta(\hat{}\alpha)$ in which the common noun function directly selects some model individual for the α-term and the interpretation of such an expression would be a truth value. The translation, 3.20 T1 , instead gives a logically equivalent expression in a longer form in which the β-function and its α-argument are separated in different t-level entailments that are conjoined and share a u-variable: $\forall z \forall u\ [\beta(\hat{}u) \wedge u = \alpha]$. The reason for this additional complexity in the longer form of the equivalent expressions is to provide a rather more limited meaning for the negative expression: $\forall z \forall u\ [\beta(\hat{}u) \wedge \neg\, u = u_n]$. The claim of this form of rejection is that Shannon did not negate any predication directly; but rather, she only negated entailed relations to someone who could be determined pragmatically-- the indexing, u_n , on a semantically unbound variable is intended for pragmatical binding with information that is formally unavailable for semantics. When she said NO BANANA , Shannon was rejecting someone's relationship to the fruit which had a presumptive existence. Usually the someone in the u_n position was herself, but occassionally she would meaningfully intend that someone else was not to have the predicated item. NO BANANA never meant that an expected banana was not present (although there would be no difficulty in constructing nonexistence: $\forall z \neg \forall u\ [\underset{\sim\sim\sim\sim\sim\sim}{\text{BANANA}}'(\hat{}u)]$ or

nonpredication: $\forall z \forall u\ [\neg$ BANANA'$(\hat{}u)]$ both of which were understood in Bloom's Kathryn). All of Shannon's negations would be counter to fact if they were interpreted as direct negations of single predicate functions. The 3.20 grammar links the interpretation of rejection directly to a genitive-like interpretation which is evident in the data. The denial negation, NO WET , is an elegant demonstration of relational specification rule, S5-T5 , giving independent syntactical motivation for the lambda-abstraction process for common noun properties. A good sense of coherence is achieved in this grammar by the compositional relationship between rejection and denial.

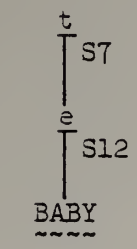
There remain a couple of nontrivial problems with this negative formulation for her rejections. 3.20 is clearly noncategorial, but other such rules which violate the principle of categoriality seem to be independently motivated so nothing is lost here. The simpler categorial negation rule: $t \rightarrow t/t\ t$, would massively overgenerate the sample as it would predict many forms of negation which were not observed and some of these would seem counterintuitive. Neither Shannon nor Kathryn spoke of individual nonexistence: * NO STAN meaning that no individual named STAN exists: $\neg \forall u\ [u =$ STAN'$]$; or meaning that there was an individual who was not named STAN: $\forall u\ [\neg\ u =$ STAN'$]$, although this last form is predicted by Bloom's grammar in her interpretation of nonexistence and the lack of term and common noun distinction. The categorial negation with the holophrastic negation would produce the often observed child form: * NO NO but it would assign a compositional meaning to affirm the presupposed proposition rather than the doubled negative interpretation usually ascribed to children.

A less trivial problem of this rejective negation form concerns the use of the indexed variables. As written the semantical interpretation of most propositions will be technically incomplete since the indexed variable is unbound resulting in an open proposition. Truth values cannot be assigned to open propositions. The purpose of this indexing of variables in the 3.20 grammar is to indicate where pragmatical information is needed in complete interpretation, and as such, this practice violates semantical autonomy. This is a serious flaw as one of the guiding motivations in this form of grammar is to couple an autonomous syntax with an autonomous semantics. This indexing practice is introduced here to tentatively suggest how pragmatics can be construed to interact with semantical interpretation, although this direct practice amounts to interference until the pragmatical component is formally specified. Many child language studies since Bloom (1970) have been claiming that semantics and pragmatics are not differentiated at this period of syntactical emergence so that semantical meanings must be determined on the basis of pragmatical intuitions of any kind of contextual information. If semantics and pragmatics did interact in this way, the distinction between them is probably lost and a single form of rule should properly account for their phenomena. It would be difficult to account for nonactual state descriptions with such a grammar, and that would be a nontrivial loss compared to the intensional interpretations of this grammar. The forthcoming section, 3.3, on the structure of intensional model specification will introduce pragmatical information in a better manner, although not less arbitrarily.

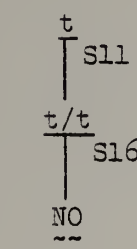
3.23 Holophrases: analysis trees and derivations



i.	φ	exponent
ii.	$\forall \underline{z} \forall \underline{u} [\underline{z}(\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z})]$	by T10
iii.	$\forall \underline{z} \forall \underline{u} [\underline{z}(\hat{}\underline{u}) \wedge \underset{\sim\sim\sim\sim\sim}{\text{UH-OH}}'(\hat{}\underline{z})]$	by T15



i.	φ	exponent
ii.	$\forall \underline{u} [\underline{u} = \alpha]$	by T7
iii.	$\forall \underline{u} [\underline{u} = \underset{\sim\sim\sim\sim}{\text{BABY}}']$	by T12



i.	φ	exponent
ii.	$\forall \underline{u}_2 [\varphi'' \wedge \zeta\, \underline{u}_2 = \underline{u}_1]$	by T11
iii.	$\forall \underline{u}_2 [\varphi'' \wedge \lambda \underline{P} [\neg \underline{P}]\, \underline{u}_2 = \underline{u}_1]$	by T16
	$\forall \underline{u}_2 [\varphi'' \wedge \neg\, \underline{u}_2 = \underline{u}_1]$	λ-convert
iv.	$\forall \underline{u}_2 [\underset{\sim\sim\sim\sim}{\text{SOUP}}''(\hat{}\underline{u}_2) \wedge \neg\, \underline{u}_2 = \underline{u}_1]$	presuppositional inference

The semantical theory of the child's holophrastic speech is one of the more extraordinary features of this grammar as it must attribute fairly powerful logical devices in order to interpret the single word as truth related propositions. There has been considerable literature of child language studies to indicate that these first unitary expressions are not merely isolated parts of speech, but rather they are categorical interpretable-- although no formal treatment of the holophrase has been offered which can interact with the onset of combinatorial abilities.

In this grammar, the S7 rule produces a sentence from any term in the category, and the corresponding T7 translation supplies the meaning that such an individual exists from some reference point in the model. The holophrastic interpretation is very wide in comparison to expressions which have some syntactical specification-- the holophrastic MAMA refers to any possible reference concerning that individual. This is a remarkably broad interpretation from the semantical component, but the pragmatics of the situation could sometimes narrow the range of model reference when reference was obvious. In point of fact, there were many instances in which holophrastic interpretation could not be narrowed to a point where satisfactory propositional interpretation could be made. In such instances the conversation might lapse or proceed abruptly into a new topic, the adults being unable to interpret some utterances very closely. Before the emergence of two-word utterances, the distinctions between term and common noun did not seem so distinct and became evident post hoc. It would be hard to specify exact lexical membership in these categories during the period of purely single words; although, replacement sequences and specification by properties (like the t//e-modifying UH-OH which should contrast with the e-modifying NITE-NITE) could help.

The holophrastic interpretation for common nouns in T8, however, is an intuitively pleasing notion. The u-variable in the translation ties common noun reference to a model individual, and there was usually some person in the real world who indicated the actual object referred to-- holding it, pointing to it, looking at it, and so on. Where JUICE could refer to any number of different things, such real-world tie up

is not needed to establish the referent for many terms, like MAMA or STAN . It has already be mentioned that terms like BABY and DOGGIE in her emergent syntactical combinations suggests some inconsistency in Shannon's grammar, because the syntactical categories seem to contain mixtures of semantical functions. Shannon will need some major reanalysis on the categorical distinction between terms and nouns so that stage-like changes in her grammar can be expected with growth.

Expressions like WASH or BYE-BYE require a distinguishable and different sort of interpretation from the term holophrase. This function is not uniquely assignable to an individual like the terms, but it is an assignment to sets of individuals much like common nouns. These expressions refer to properties of these sets of individuals, and whether a particular individual was a member of a property set could change from one reference point to another. This categorical distinction seems patently manifest even in the period of single utterances with only holophrastic interpretation, as Shannon did not ascribe BYE-BYE to noun-like things like JUICE nor ALL-GONE to departed individuals although it might be sensible in the adult language to do so.

The holophrastic UH-OH brings with its T10 translation some additional logical interpreting equipment due to the categorical distinction of terms and nouns mentioned above. In Shannon's speech, the expression UH-OH referred to the property of something which has been spilled or knocked over and there was usually someone who was either responsible for its condition or its correction. The UH-OH is interpreted as a property of properties of individual concepts and it carries in its logical translation a z-entailment that there exists something belonging to

someone and the δ-expression specifies a property of that something.

Holophrastic negative answering is not usually part of semantical analysis since its use depends upon conversational sequence and it can not be fully interpreted without the use of presuppositional information which is not a proper part of the sentence grammar. Translation T11 makes use of such inferences as in the 3.23 NO holophrase and specifically negates the pragmatical relationship of someone to that inference. Again, this is a very broad interpretation as it applies to virtually any proposition from any reference point in the model, but there were circumstances-- among the most bewildering to adults-- when Shannon would exclaim a series of negative holophrases without any prior conversational precursor. Her mother adopted a strategy of presenting sentences of any content that would come to mind and proceed through a conversation by elimination. Appendix A, 27 Oct 76, 552PM provides a brief example of this.

This treatment of the holophrase utterances, the many semantical variables, the pragmatical indexing, the presuppositional inferences, and so on may seem counterintuitive to the naive notion that a child's first words are simple things by nature. Any theory of child language is faced with the problem of semantical compression which seems evident at the emergence of syntax: children seem to mean more with a single word than a uniform lexical interpretation could provide. Most parents begin to carry on holophrastic conversations with their child that quite early requires some form of logical translation into expressions which have more formal power than unitary syntax. This treatment is at least descriptively adequate toward almost all of the presenting data, and

when the earliest binary syntax emerges, the combinatorial operations work directly with compositional meanings like the holophrastic devices in a binary manner. The advantage for the child's communication in combinational syntax is that it narrows the interpretive range which is so very large with only a holophrastic grammar. Language acquisition might be thought of as a developmental process of learning to specify increasingly narrower ranges in the interpretive model. Nonactual reference points would be among the most difficult to indicate with the holophrastic devices. It should not be surprising, then, to discover propositions concerning states of affairs which do not exist in the actual situation as some of the most interesting utterances in the early two-word stage.

3.3 Intensionality is the ability to adopt a different reference point. There has been much in the child language literature concerning the use of extralinguistic context in determining the meaning of early utterances:

> "...the basic assumption that it was possible to reach the semantics of children's sentences by considering nonlinguistic information from context and behavior in relation to linguistic performance...."
> (Bloom 1970 : 10)

This assumption amounts to a claim that early child language is based upon extensional interpretation-- that is, there is fundamental reference by which all sentences establish their meanings and that reference point is the here-and-now situation observable to child and adult alike. Whenever a child produces a sentence, the meaning of that sentence is ascertained by pragmatical intuition upon the particular circumstances

of that moment. Indeed, Bloom's study maintains that the double-noun surface structure is assigned any of its different meanings in accordance with situational intuitions. The result of situational interpretation is a fairly large number of equivocal circumstances in which the meaning assignment could not be certain or more than one interpretation could apply, resulting in ambiguity. This assumption of extensional interpretation does not well fit Shannon's conversational performances in which the meanings of her syntactical constructs were consistently understood and were frequently referring to nonexistent states of affairs which did not require situational reference. To illustrate her ability to adopt other reference points, especially the nonactual, it is necessary to restore pragmatical features of conversation and introduce some discussion of minimal contrast replacement sequences and the role of false assertions in early child language. Fortunately, these are very common occurrences.

3.30 Transcript fragments: contrast replacement sequences

DAVID, Weir (1966)	STEVEN, Braine (1965)	KATHRYN, Bloom (1970)
31 months old	25 - 26 months old	22 months, 2 weeks old
I GO DIS WAY	MAN	CEREAL
WAY BAY	CAR	HMMMM
BABY GO DIS BIB	MAN	RAISIN THERE
ALL BIB	IN CAR	BUY MORE GROCERY STORE
BIB	MAN	RAISINS
DERE	IN THE CAR	BUY MORE GROCERY STORE
		GROCERY STORE
36 months old		RAISIN = GROCERY STORE
STOLY	STEVIE GUN	
STOLY HERE	TOMMY	
WANT A STOLY	STEVIE GUN	
DAVE STOLY	TOMMY GIVE GUN	
STORY	GUN	
STORY	TOMMY	
STORY'S DE HAT	GUN	
STORY'S DE BIG HAT	TOMMY	
STORY'S A HAT	GIVE STEVIE GUN	

Weir (1962) first discussed sequences of utterances as containing interesting acquisitional phenomena in relation to her studies of early phonology and intonation. Her method was to record presleep monologues of her children in their cribs, and she noticed a rehersal-like pattern of substitutions with newly acquired sounds and intonational contours. The first of the David fragments (Weir 1966) is focused upon consonant-vowel-consonant intonational forms, while the second fragment practices the /r/ phoneme which was newly acquired at that time. Braine (1965) discussed replacement sequences in a more narrow form found in the conversation of children. Each of the two Steven samples are sequences of utterances which vary in their syntax but are cumulative upon a single semantic meaning. Bloom (1970) also presents a replacement sequence, and, like Braine, she considers this as evidence for larger underlying syntactical structures which are reduced to the level of surface performance. Scollon (1976) has also brought this syntactical notion for sequences of early holophrastic utterances called vertical constructions. In the syntactical replacement sequence, a larger semantical meaning is held constant while sequences of syntactical structures approximate its components. The replacement sequence is a major conversational device for children, and it appears to have some sensitivity for acquisitional phenomena in phonology and syntax, but a predominantly syntactical explanation for its form falls slightly short of the mark. There are comparable replacement sequences which hold syntax constant and vary with the semantical components.

The following transcript fragment contains a drowsy monologue of Shannon while nursing in which she systematically exchanges all of the

common nouns held in genitive predication with the possible individuals who were present. The actual pragmatical situation remained constant throughout: Shannon was nursing at breast; her mother was drinking coffee; and Stan was drinking tea. At one point she picks up a teddy bear from the kitchen table, hugs it, and places it up to the breast; but otherwise she returns to nursing and talking for herself. There three syntactical replacements within this sequence which involve the noun property HOT and the apparent term property HUG . Otherwise, the genitive construct is held constant while the semantical components are systematically exchanged.

3.31 Transcript fragments: minimal contrast replacement sequence

Shannon; 22 months, 26 days old; excerpt 27 Oct 1976

619PM...	MAMA COFFEE		621...	STAN TEA	
	MAMA COFFEE			STAN TEA	
	MAMA COFFEE			STAN BREAST	
	MAMA COFFEE			STAN BREAST	
	MAMA COFFEE			STAN BREAST	
	MAMA TEA			STAN BREAST	
	MAMA COFFEE			STAN BREAST	
	MAMA COFFEE			STAN BREAST	
	MAMA COFFEE			STAN BREAST	
	HOT				
	HOT		622	STAN TEA	
	MAMA TEA?			STAN TEA	
	MAMA TEA?			STAN TEA	
	MAMA COFFEE			MAMA COFFEE	
	MAMA COFFEE			SHANNON COFFEE	
	MAMA COFFEE			SHANNON COFFEE	
	STAN TEA?			BABY COFFEE?	(Noticing teddy bear on the table)
	MAMA COFFEE				
	STAN TEA			BABY HUG	(She hugs teddy bear)
620		(Nurses)		BABY HUG	
				BABY BREAST?	(Puts bear to breast)
621	MAMA COFFEE			BABY BREAST?	
	MAMA COFFEE			BABY BREAST?	
	MAMA COFFEE			SHANNON BREAST	
	MAMA HOT			SHANNON BREAST	
	MAMA HOT			SHANNON BREAST	
	MAMA HOT				
	MAMA HOT		623	STAN TEA	
				STAN COFFEE	
					Mother: Stan no coffee
				STAN TEA...	

The phenomenon in the focus of this replacement series involves the semantical elements as the syntax is consistent and unremarkable. The genitive structure is newly acquired, but it is her most secure combinatorial ability. There should be no doubt that the pragmatical situation and Shannon's behavior remained constant throughout this monologue so that the exchanged interpretations cannot rely upon here-and-now intuitions to uniformly determine the meanings of the utterances. MAMA COFFEE has an extensional referent while MAMA TEA does not. What then is being contrastively exchanged throughout this seuqence?

As an effort to maintain the extensional assumption as a basis for the semantics, it might be considered that truth and falsity are being contrasted. The extension of MAMA TEA in the here-and-now reference point is the truth value: false. There are several problems with this treatment. It was Weir's notion that these sequences were focused upon some newly acquired linguistic forms as a practicing mechanism, yet the rehersal of truth versus falsehood is not likely to be something new with the emergence of combinatorial structures. The long holophrase period before this is characterized by truth-valued single word sequences. Even more to the point, the true-false distinction is not being systematically contrasted: MAMA TEA and ∅ MAMA BYE-BYE are equally false of the situation and yet there is no syntactical replacement producing a falsehood in the sequence. False syntactical contrasts are not present in this series.

A more general problem with the extensional basis for meaning is that it becomes clearly nonintuitive with the emergence of syntax. In

Shannon's general speech, many of her utterances were extensionally false to the pragmatical reference, and some of them, like the negatives, appeared systematically untrue of the actual situation. The adults who spoke with her were uniformly disinclined to consider these utterances as false assertions. The acquisition of syntax did not give Shannon the status of lair making untrue statements about the actual world, but she did acquire an increased ability to speak about nonactual matters.

Intensionality is the ability to adopt a different reference point. Shannon's mother was the first one to notice the intensional nature of these replacement sequences: "Shannon has been doing a strange thing lately. She has been switching things around. She starts with the way things are and then puts them together differently-- in ways that it is possible for them to be." This is the focus of the 3.31 replacement sequence: the intensional reference structure of a model interpretation. In the constant syntactic frame, Shannon rather systematically switches around the four possible individuals with the three predicated nouns into possible combinations. Some of the combinations were actual at that time: MAMA COFFEE , STAN TEA , SHANNON BREAST , BABY BREAST ; some were actual but at other times and places: MAMA TEA , SHANNON COFFEE , BABY COFFEE ; and some had never actually happened at any time or place: STAN COFFEE , STAN BREAST .

It is possible to specify this replacement sequence with the kind of set theoretical model given in 2.25. Again, some arbitrary restrictions are needed on the exponential size of a total cartesian-product model of all possibilities. Given the two truth values, the four possible individuals, and the three common nouns for genitive predication;

there are 4096 possible reference points and the actual situation is one of these. Some of these references cannot be specified within a single two-word sentence-- such as the possible situations where mother has both tea and coffee which cannot be adopted within a single token since only two words are syntactically available. It seems a simple matter to exclude such reference points for multiple predication which her present syntax lacks and claim that such meanings are unspecified in this limited model. To further restrict the size of interpretation, it is also possible to limit the model to this particular performance and leave out any reference points not actually present in the circumstances of this particular replacement sequence. These limitations which leave portions of the complete model interpretation unspecified are adopted here more for exposition than the more serious claim of psychological reality for this kind of model limitations. The issues concerning the exponential size of model interpretations of intensional logic are more probably performance matters rather than issues of mental competence.

The 3.32 model below will distinguish two reference points in all predicate specifications: I1 and I0 . This is introduce a method for anchoring a model with pragmatical intuitions available from perceptible information. The anchored reference point, I1 , shall contain information pertaining to the actual situation; while the point, I0 , shall be an antipragmatic world in which all predication is false. The purpose of this antipragmatic anchoring is to specify that the assertion of a single extensionally true predicate presupposes the knowledge of conditions under which that predicate would false. This seems to be the smallest part of an intensional model that would be used by a child who

only spoke truely of the here-and-now. The nonanchored reference points in 3.32 are added serially within each function. Taking the replacement sequence as a collective or additive phenomenon in discourse, whenever Shannon produced a nonactual predication it has the effect of specifying the model structure where it is possibly true and possibly false.

3.32 Model interpretation for intensional replacement sequence

Set of Possible Individuals {{MA,SH,ST,D1},

Set of Reference Points {I0,I1, ... ,I23},

Set of Truth Values {0,1},

Values of Intensional Functions

$D_{\langle s,e\rangle}$ (individual concepts)

F(MAMA') = {(I0,MA),(I1,MA), ... ,(I23,MA)},

F(SHANNON') = {(I0,SH),(I1,SH), ... ,(I23,SH)},

F(STAN') = {(I0,ST),(I1,ST), ... ,(I23,ST)},

F(BABY$_1$') = {(I0,D1),(I1,D1), ... ,(I23,D1)},

$D_{\langle s,\langle\langle s,e\rangle,t\rangle\rangle}$ (properties of individual concepts)

F(COFFEE') = {(I0 ,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 0),
({(I0,SH),(I1,SH), ... ,(I23,SH)}, 0),
({(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
({(I0,D1),(I1,D1), ... ,(I23,D1)}, 0)}),
(I1 ,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 1),
({(I0,SH),(I1,SH), ... ,(I23,SH)}, 0),
({(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
({(I0,D1),(I1,D1), ... ,(I23,D1)}, 0)}),
(I2 ,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 0),
({(I0,SH),(I1,SH), ... ,(I23,SH)}, 1),
({(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
({(I0,D1),(I1,D1), ... ,(I23,D1)}, 0)}),
(I3 ,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 0),
({(I0,SH),(I1,SH), ... ,(I23,SH)}, 0),
({(I0,ST),(I1,ST), ... ,(I23,ST)}, 1),
({(I0,D1),(I1,D1), ... ,(I23,D1)}, 0)}),

```
(I4 ,{{(I0,MA),(I1,MA), ... ,(I23,MA)}, 0),
     {(I0,SH),(I1,SH), ... ,(I23,SH)}, 0),
     {(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
     {(I0,D1),(I1,D1), ... ,(I23,D1)}, 1)}),
(I5 ,{{(I0,MA),(I1,MA), ... ,(I23,MA)}, 1),
     {(I0,SH),(I1,SH), ... ,(I23,SH)}, 1),
     {(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
     {(I0,D1),(I1,D1), ... ,(I23,D1)}, 0)}),
(I6 ,{{(I0,MA),(I1,MA), ... ,(I23,MA)}, 1),
     {(I0,SH),(I1,SH), ... ,(I23,SH)}, 0),
     {(I0,ST),(I1,ST), ... ,(I23,ST)}, 1),
     {(I0,D1),(I1,D1), ... ,(I23,D1)}, 0)}),
(I7 ,{{(I0,MA),(I1,MA), ... ,(I23,MA)}, 1),
     {(I0,SH),(I1,SH), ... ,(I23,SH)}, 0),
     {(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
     {(I0,D1),(I1,D1), ... ,(I23,D1)}, 1)}),
(I8 ,{{(I0,MA),(I1,MA), ... ,(I23,MA)}, 0),
     {(I0,SH),(I1,SH), ... ,(I23,SH)}, 1),
     {(I0,ST),(I1,ST), ... ,(I23,ST)}, 1),
     {(I0,D1),(I1,D1), ... ,(I23,D1)}, 0)}),
(I9 ,{{{(I0,MA),(I1,MA), ... ,(I23,MA)}, 0),
     {(I0,SH),(I1,SH), ... ,(I23,SH)}, 1),
     {(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
     {(I0,D1),(I1,D1), ... ,(I23,D1)}, 1)}),
(I10,{{{(I0,MA),(I1,MA), ... ,(I23,MA)}, 0),
     {(I0,SH),(I1,SH), ... ,(I23,SH)}, 0),
     {(I0,ST),(I1,ST), ... ,(I23,ST)}, 1),
     {(I0,D1),(I1,D1), ... ,(I23,D1)}, 1)}),
(I11,{{{(I0,MA),(I1,MA), ... ,(I23,MA)}, 1),
     {(I0,SH),(I1,SH), ... ,(I23,SH)}, 1),
     {(I0,ST),(I1,ST), ... ,(I23,ST)}, 1),
     {(I0,D1),(I1,D1), ... ,(I23,D1)}, 0)}),
```

```
                (I12,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 1),
                     ({(I0,SH),(I1,SH), ... ,(I23,SH)}, 1),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
                     ({(I0,D1),(I1,D1), ... ,(I23,D1)}, 1)},
               (I13,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 1),
                     ({(I0,SH),(I1,SH), ... ,(I23,SH)}, 0),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 1),
                     ({(I0,D1),(I1,D1), ... ,(I23,D1)}, 1)}),
               (I14,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 0),
                     ({(I0,SH),(I1,SH), ... ,(I23,SH)}, 1),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 1),
                     ({(I0,D1),(I1,D1), ... ,(I23,D1)}, 1)}),
               (I15,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 1),
                     ({(I0,SH),(I1,SH), ... ,(I23,SH)}, 1),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 1),
                     ({(I0,D1),(I1,D1), ... ,(I23,D1)}, 1)})},
F(TEA') = ((I0 ,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 0),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 0)
           (I1 ,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 0),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 1)}),
               (I16,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 1),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 0)}),
               (I17,{({(I0,MA),(I1,MA), ... ,(I23,MA)}, 1),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 1)})},
F(BREAST') = ((I0 ,{({(I0,SH),(I1,SH), ... ,(I23,SH)), 0),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
                     ({(I0,D1),(I1,D1), ... ,(I23,D1)}, 0)}),
           (I1 ,{({(I0,SH),(I1,SH), ... ,(I23,SH)}, 1),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
                     ({(I0,D1),(I1,D1), ... ,(I23,D1)}, 1)}),
               (I18,{({(I0,SH),(I1,SH), ... ,(I23,SH)}, 1),
                     ({(I0,ST),(I1,ST), ... ,(I23,ST)}, 0),
                     ({(I0,D1),(I1,D1), ... ,(I23,D1)}, 0)}),
```

$D_{\langle s,\langle\langle s,\langle\langle s,e\rangle,t\rangle\rangle,t\rangle\rangle}$

properties of properties of individual concepts

$D_{\langle s,\langle\langle s,e\rangle,\langle\langle s,e\rangle,t\rangle\rangle\rangle}$

intensional relations between individual concepts

$$
\begin{aligned}
&\langle I19,\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\ 0\rangle,\\
&\qquad \{\{\langle I0,ST\rangle,\langle I1,ST\rangle,\ \ldots\ ,\langle I23,ST\rangle\},\ 1\rangle,\\
&\qquad \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\ 0\rangle\}\rangle,\\
&\langle I20,\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\ 0\rangle,\\
&\qquad \{\{\langle I0,ST\rangle,\langle I1,ST\rangle,\ \ldots\ ,\langle I23,ST\rangle\},\ 0\rangle,\\
&\qquad \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\ 1\rangle\}\rangle,\\
&\langle I21,\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\ 1\rangle,\\
&\qquad \{\{\langle I0,ST\rangle,\langle I1,ST\rangle,\ \ldots\ ,\langle I23,ST\rangle\},\ 1\rangle,\\
&\qquad \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\ 0\rangle\}\rangle,\\
&\langle I22,\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\ 0\rangle,\\
&\qquad \{\{\langle I0,ST\rangle,\langle I1,ST\rangle,\ \ldots\ ,\langle I23,ST\rangle\},\ 1\rangle,\\
&\qquad \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\ 1\rangle\}\rangle,\\
&\langle I23,\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\ 1\rangle,\\
&\qquad \{\{\langle I0,ST\rangle,\langle I1,ST\rangle,\ \ldots\ ,\langle I23,ST\rangle\},\ 1\rangle,\\
&\qquad \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\ 1\rangle\}\rangle\}\rangle,
\end{aligned}
$$

$$
\begin{aligned}
\overset{\frown}{F}(\underline{HOT}') = \{&\langle I0,\{\{\langle I0,\{\{\langle I0,MA\rangle,\langle I1,MA\rangle,\ \ldots\ ,\langle I23,MA\rangle\},\ 0\rangle\},\\
&\qquad \{\langle I1,\{\{\langle I0,MA\rangle,\langle I1,MA\rangle,\ \ldots\ ,\langle I23,MA\rangle\},\ 1\rangle\}\},\ 0\rangle\},\\
&\langle I1,\{\{\langle I0,\{\{\langle I0,MA\rangle,\langle I1,MA\rangle,\ \ldots\ ,\langle I23,MA\rangle\},\ 0\rangle\},\\
&\qquad \{\langle I1,\{\{\langle I0,MA\rangle,\langle I1,MA\rangle,\ \ldots\ ,\langle I23,MA\rangle\},\ 1\rangle\}\},\ 1\rangle\}\rangle,
\end{aligned}
$$

$$
\begin{aligned}
\overset{\frown}{F}(\underline{HUG}') = \{&\langle I0,\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\\
&\qquad \{\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\ 0\rangle,\\
&\qquad\ \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\ 0\rangle\}\rangle,\\
&\qquad \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\\
&\qquad \{\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\ 0\rangle,\\
&\qquad\ \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\ 0\rangle\}\rangle\}\rangle,\\
&\langle I1,\{\{\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\\
&\qquad \{\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\ 0\rangle,\\
&\qquad\ \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\ 1\rangle\}\rangle,\\
&\qquad \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\\
&\qquad \{\{\{\langle I0,SE\rangle,\langle I1,SE\rangle,\ \ldots\ ,\langle I23,SE\rangle\},\ 1\rangle,\\
&\qquad\ \{\{\langle I0,D1\rangle,\langle I1,D1\rangle,\ \ldots\ ,\langle I23,D1\rangle\},\ 0\rangle\}\rangle\}\rangle\}

It seems to be the nature of the 3.31 replacement sequence to exercise the newly acquired semantic ability to specify possible states of affairs in a manner which suggests an intensional model structure, something like 3.32. Each of the individual concepts is uniformly treated as rigid designators whose intensional functions select the same individuals from all reference points. This is clearly not an adequate formal treatment for the term BABY which selects some different referents in situations other than the pragmatic instance of that afternoon. In this setting the teddy bear was the only doll present in the kitchen at that time, so it does not seem extreme to simplify its presentation in this model so that it is like the other individual concepts mentioned in this sequence. The other terms were consistent in selecting only those individuals in all circumstances. With model elements for these four possible individuals forming a restricted domain, the function F(COFFEE') is specified with all sixteen possible unitary-possession situations since Shannon did predicate COFFEE of each of the individuals at some place in this sequence. This method of constructing the model with the cartesian principle applied only within each predicate as specified in a performance, uses only a subset of the total model interpretation for economic exposition-- that is, Shannon's mental competence is expected to be complete for the total interpretation and not restricted to the size of this particular performance. F(TEA') has but four reference points in this partial model since only two individuals were provided within this performance. The complete model would contain a uniform specification for all of the properties of individual concepts-- COFFEE' , TEA' , and BREAST' . The more complete model is probably preferred for general

purposes as performance limitations upon model structure is not a very pleasing notion for the semantical component of the grammar. Since Shannon has the ability to specify a partial model as in 3.31, it is no large assumption to credit her with competence for the larger complete interpretation because the recursive definitions for both are simple knowledge. In actual performance it would be rare to find all possibilities systematically stated and it is necessary to infer complete knowledge from various fragments.

The syntactical replacement involving HOT did maintain an extensionally true relationship with the real world, and so they are not modeled with intensionally possible combinations, like ∅ HOT BREAST. This combination would probably be understood by Shannon even though no such referent had ever been encountered. It would be of interest to find an intensional replacement sequence on the level of the properties of properties of individual concepts in order to determine if intensional reference is understood over all common nouns: ∅ HOT ICE , ∅ SHARP BANANA , and the like which might never have an extensionally true referent in the here-and-now and yet are possible combinations predicted by the grammar. 3.31 is evidence of intensional replacement within the genitive construction but that does not necessarily require that intensionality be uniform across the entire grammar. The construction of interpretive models would be simpler if intensionality were found to be uniform.

The model interpretation seems to be a better repository for the informal pragmatical intuitions than the semantical rules. It would be a simple matter to bind the indexed variables with existential quanti-

fication and thereby complete the semantical interpretation. The advantage of doing this is to achieve semantical autonomy in the grammar and to do this with only the forms of knowledge presently in 3.32. Simpler grammars result from autonomous components and these should be preferred in child language since less is required of learning. By claiming an interpretation in the semantical component that is independent of syntax and pragmatics, it is possible to evaluate child grammars in the same manner as the adult grammars since their componential integration would be essentially the same. One could expect more complicated rules in the mature grammar, but not rules which differ in kind from the lower level of communication with the child.

It should be noticed that HUG is assigned an extensional structure in I1 as an intensional relation between two individual concepts purely upon pragmatical assumptions since the example * BABY HUG is a counter-example to the 3.20 grammar.

Omitting the redundancies in the actual performance, it is possible to give the complete semantical specifications for the intensional replacement sequence, 3.32. These specifications require ranges of intensional references in which the proposition is found to be true and there is no particular significance to the pragmatically anchored I1 except in those constructs which are not part of the intensional exchange.

3.33 Semantical specifications for replacement sequence

$$\forall z \forall u \, [\text{COFFEE}'(\hat{}u) \wedge u = \text{MAMA}']^{3.32;\langle I1,I5,I6,I7,I11,I12,I13,I15\rangle;G} = 1$$

$$\forall z \forall u \, [\text{TEA}'(\hat{}u) \wedge u = \text{MAMA}']^{3.32;\langle I16,I17\rangle;G} = 1$$

$$\forall z \forall u \, [z(\hat{}u) \wedge \text{HOT}'(\hat{}z)]^{3.32;\langle I1\rangle;G} = 1$$

$?\forall z \forall u\ [\underset{\sim\sim\sim}{\text{TEA}}'(\hat{}u) \wedge u = \underset{\sim\sim\sim\sim}{\text{MAMA}}']^{3.32;<I16,I17>;G} = 1$

$?\forall z \forall u\ [\underset{\sim\sim\sim}{\text{TEA}}'(\hat{}u) \wedge u = \underset{\sim\sim\sim\sim}{\text{STAN}}']^{3.32;<I1,I17>;G} = 1$

$\forall z \forall u\ [\underset{\sim\sim\sim}{\text{TEA}}'(\hat{}u) \wedge u = \underset{\sim\sim\sim\sim}{\text{STAN}}']^{3.32;<I1,I17>;G} = 1$

$\forall z \forall u\ [\ z(\hat{}u) \wedge \underset{\sim\sim\sim}{\text{HOT}}'(\hat{}z) \wedge u = \underset{\sim\sim\sim\sim}{\text{MAMA}}']^{3.32;<I1>;G} = 1$

$\forall z \forall u\ [\underset{\sim\sim\sim\sim\sim\sim}{\text{BREAST}}'(\hat{}u) \wedge u = \underset{\sim\sim\sim\sim}{\text{STAN}}']^{3.32;<I19,I21,I22,I23>;G} = 1$

$\forall z \forall u\ [\underset{\sim\sim\sim\sim\sim\sim}{\text{COFFEE}}'(\hat{}u) \wedge u = \underset{\sim\sim\sim\sim\sim\sim\sim}{\text{SHANNON}}']^{3.32;<I2,I5,I8,I9,I11,I12,I14,I15>;G} = 1$

$?\forall z \forall u[\underset{\sim\sim\sim\sim\sim\sim}{\text{COFFEE}}'(\hat{}u) \wedge u = \underset{\sim\sim\sim\sim}{\text{BABY}_1}']^{3.32;<I4,I7,I9,I10,I12,I13,I14,I15>;G} = 1$

$?\forall z \forall u\ [\underset{\sim\sim\sim\sim\sim\sim}{\text{BREAST}}'(\hat{}u) \wedge u = \underset{\sim\sim\sim\sim}{\text{BABY}_1}']^{3.32;<I1,I20,I22,I23>;G} = 1$

$\forall z \forall u\ [\underset{\sim\sim\sim\sim\sim\sim}{\text{BREAST}}'(\hat{}u) \wedge u = \underset{\sim\sim\sim\sim\sim\sim\sim}{\text{SHANNON}}']^{3.32;<I1,I18,I21,I23>;G} = 1$

$\forall z \forall u\ [\underset{\sim\sim\sim\sim\sim\sim}{\text{COFFEE}}'(\hat{}u) \wedge u = \underset{\sim\sim\sim\sim}{\text{STAN}}']^{3.32;<I3,I6,I8,I10,I11,I13,I14,I15>;G} = 1$

3.4 Subsequent language development is a major theme in the proper description of a child's grammatical abilities. One set of formal devices is offered at one time to represent a child's grammar; and then at a subsequent time, another set is offered as evidence that learning of some rule-governed ability has occurred within the same time interval. Theories of language acquisition seek to explain how these grammars develop through chronological intervals; what new rules and categories are added; how old rules are changed; and so forth.

A synchronic analysis is based upon collecting enough samples of sentences to characterize grammatical abilities by contrasting different structures and types. It requires a period of time to collect these sentences and since there is a single grammar given to represent all of these sentences, there is an implicit assumption that no great change in the grammar occurred during the period of sampling. Evidence for rule learning as discrete mental operations must lie somewhere between the

sampling periods and not within them. Synchronic analyses in chronological order are a rudimentary step in demonstrating what a child has learned, when it was learned, but not how it was learned.

Shannon's subsequent development for the next month did seem to concern common nouns, some new categories, and more abilities in combining categories. These changes occur rather discretely as a compositional rule theory would want it.

Corpus Entry	Date	Interval	Age
28	27 Oct 76		22 mo 26 da
		8 da	
29	4 Nov 76		23 mo 3 da
		6 da	
30	10 Nov 76		23 mo 9 da
		17 da	
31	27 Nov 76		23 mo 26 da

Each of these samples differ situationally so that Shannon's conversation is the predominant feature common to all of them. The earliest sample, 3.11 presented below, was taken in her home with her mother and researcher present while the latter directly wrote down each utterance as observed for a measured hour. This is known as an observational transcript and was the most common form of data collection during the holophrastic period of her development. Shannon's clear articulation and high degree of repetition made this form of transcription the most efficient process to accumulate grammatical evidence. The twenty-nineth sample, eight days later, is again in her home alone with the researcher baby-sitting for the evening. Shannon's separation anxiety is registered in the frequency of her MAMA COME-BACK assurances. Her uncle, Ronnie, who lived in the basement, comes in toward the end of the observational hour. The next sample, number 30 in the corpus, was taken six days later during an even-

ing when Shannon was visiting the researcher's apartment while her parents were away attending a childbirth meeting. Shannon was helping her adult friend, Sheila, in the kitchen and setting the table for supper. The thirty-first entry was collected seventeen days later when Shannon's father tape recorded and transcribed an hour's conversation while playing with her before the dinner which mother was preparing. All of her transcripts are about the same length and may be examined (Appendix A) for their conversational sequence and the situation of their occurrence.

During the eight day interval between the first and second samples very little learning seems to take place. By and large, the same kinds of structures and meanings appear in her conversation. During the next six days to the third sample, however, some additional rules and categories become apparent in her performance which were not reliably produced in the previous samplings, although some of the types appeared infrequently as counterexamples. The last seventeen day interval to the fourth sample is again stable as little change is evident from her abilities of the third sample. This chronological sampling seems to indicate that most of the grammatical change during this month occurred during a relatively brief period between the second and third samples with stable periods on either end of the chronology. This is indirect evidence for the acquisition of discrete mental abilities which are here formulated as categories and rules. The step-like addition of new rule-governed abilities underscores the need for increasingly small intervals for synchronic sampling. Certainly the five month interval for Braine's (1963) sample of Andrew is too large for a single grammatical analysis unless the variation in rate of learning from Shannon to Andrew is very

large. Even Bloom's (1970) sampling period of a week can be questioned as it might incorporate the discrete addition of some new abilities so that a very different grammar may be operating to produce the end of the sample than was operating to produce the beginning of it. A synchronic analysis is then a difficult device with respect to the task of developmental explication since such analyses become more secure with larger samples. The developing child, however, may be inherently an unstable source for this kind of analysis as the time interval for changing the grammar may be too small to produce a large enough sample for a reliable and secure contrast. Indeed, the shortest sampling interval might be between two utterance tokens-- the earlier being produced with one set of abilities and the second representing a new set of rules altered from the earlier. If aquisition proceeded by merely adding new rules and categories, the problems involved in the synchronic method of analysis would be minimal, as it would be possible to go through a sequence and show the first appearance of a new form not present earlier. The real problem arises if acquisition can also proceed by the reanalysis of the earlier forms into later forms which are substantially different. This acquisition by reanalysis of earlier forms is known as stage development while the acquisition by adding new forms without reanalysis is known as phase development; and, it appears that both are necessary to explain how a child progresses through language acquisition to eventually approximate a communication system compatible with the adult level.

These are problems with the general method of synchronic analysis which cannot be solved here. Some form of diachronic analysis which changes the grammar on the basis of evidence serially encountered within

a sample is needed to explicate subsequent development; but such methods are not readily available and generally lack formal consistency. The traditional studies which examine how a language changes over time have been in historical linguistics, but it is not clear whether the sociological influences which alter a community's language have much relevance to the psychological influences which alter a child's language over time. As the child grows, performance capacities for mental processes become greater and the language changes by increasing structural complexity for more detail in information. The synchronic analysis, even with its weaknesses, may be the most detailed and explicit method to represent development with a series of independent measurements. It least gives a description of what has changed, even if it lacks an explanation of how it was accomplished.

Each of the following grammars in this section are represented by specifying only the changes from the previous grammar. Shannon's development is generally phase steps-- usually adding new categories. There is, however, a stage-like reanalysis of word order in term specification which is the only syntactical change in her language since the pervious sample.

3.40 Language sample: Shannon; 23 mo 3 da

CATEGORIZATION OF ALL INTELLIGIBLE UTTERANCES
AND FREQUENCIES OF THEIR OCCURRENCE IN SAMPLE
4 November 1976

One-Word Utterances

Terms		Common Nouns				Questioned Terms	
BABY	5	CRAYON	2	ICE	1	MOMMY?	4
ELEPHANT	23	PAPER	4	ACORN	13		
DOGGIE	4	SOUP	2	SHIT	1		
SHANNON	1	PEA	2	MONICA	3		
SHEILA	3	BEAN	1	MATCHES	2	Questioned CNs	
MOMMY	2	BIKE	2	PUMPKINS	4		
		WINE	1	EYES	2		
		COKE	14	EARS	2	MONICA?	2
		COAT	6	PAPERS	4	EH?	3
				EH	2		

Term Properties		CN Properties		Negative Element		Categorical Counterexamples	
BYEBYE	1	UH-OH	1	NO	2	STAN'S	17
		YELLOW	7			LATER?	1
		TWO	1				

Two-Word Utterances

Genitive	
ELEPHANT BIKE	3
STAN'S WINE	13
DOGGIE HEAD	5
STAN HEAD	1
STAN WINE	3
SHANNON COKE	9
STAN PUMPKINS	2
MY COKE	3

Rejective Negation	
NO SOUP	7
NO COAT	8
NO MATCHES	3

Term Specification		Common Noun Specification		Combinatorial Counterexamples	
MAMA BACK?	4	HORE PAPER	1	BUNE IT	1
DADDY BACK?	1	PIECE PAPER	1	GET DOWN	1
MOMMY BACK	2	UH-OH ACORN	8	THANK YOU	2
DADDY BACK	1	UH-OH SHIT	3	MAMA SHEILA	1
		TWO ACORNS	3	TRAY ON	2
		BIG PUMPKINS	11	UH-OH ELEPHANT	1
		TWO PUMPKINS	1		

Three-Word Utterances

Term Specification		Combinatorial Counterexamples	
MAMA COME-BACK	68	PIECE A PAPER	1
DADA COME-BACK	3	BABY ELEPHANT BIKE	1
MAMA COMING-BACK	1	BABY SIT ON	2
MAMA COME BACK?	4		
BABY COME--	1		
ELEPHANT COME-BA--	1		
MOMMY COME-BACK?	3		

3.41 Grammar: Shannon; 23 mo 3 da

Lexicon of Basic Expressions

Common Nouns	:	t//e	: ... , EH , ...
Term Properties	:	t/e	: ... , BACK , COME-BACK , ...

Syntax of Phrase Structure					Example
S2	t	→	e	t/e	MAMA COME-BACK
S13	t//e	→	... , EH , ...		

Semantics of Logical Translation

T13 ... , z_n , ...

This grammar is pretty much the same as the previous 3.20 grammar with only the phrasal order of a term property and its subject term being reversed. This is a syntactical change so only S2 is specified since the semantics of the expression remained unchanged: $\forall u$ [COME-BACK'($\hat{u}$) $\wedge$ u = MAMA'] . It should be clear from the specification of term properties in the lexicon that BACK and COME-BACK are treated as separate lexical items, perhaps synonymous alternatives like MAMA and MOMMY . Many child language studies have made similar decisions to treat some multiple word chunks as single lexical entries even though the components sometimes appear individually but having the same meaning as the larger chunks.

The common noun, EH , is not a new acquisition but it did not happen to occur during the last sample. For months during the holophrase

period this expression was used to refer to something that Shannon did not know the label for. It might be thought of as a child paraphrase for the adult forms; 'this' , 'something' , or with questioning intonation, 'what?' . The translation, T13 , for EH is one of the indexed variables of the correct type for common nouns. EH was used only for items of the common noun category-- it was not used when an individual's name was unknown or for term properties and so on. She would sometimes answer an adult's question, 'What is this?' with the response, EH , recognizing that it was something but she didn't know its expression. On rare occurrences she was heard to refer to something in the genitive: Ø STAN EH , meaning whatever it is that Stan has.

This summarizes the few minor changes in her grammar in the eight days since the last sample: relative stability. Only the syntactical change reordering term specification is a step in the direction of the adult grammar. Her 3.20 grammar is more uniform in its common treatment of modifier before its head for both common nouns and terms. This is a pleasing result for those who favor more abtract phrase structure like the X-bar theories in which language-specific differences in major content phrases such as noun, verb, adjective must be learned individually from empirical evidence if the universal base is more uniform. The change in the order of the term specifier to its posthead position now seems to set the stage for analyzing a new level of verb phrase which is common for both intransitive and transitive predicates. That result is sometime in the future as the next sample introduces a new category of predicate-- the prototransitive-- which fails to have transitive reversibility that is needed for a true double predicate.

One-Word Utterances

Terms		Common Nouns		Questioned Terms		Questioned Nouns	
SHEILA	4	SHOE	2	STAN?	2	WASTEBASKET?	1
RONNIE	1	CHEESE	1	KITTY?	1	EH?	3
CATS	7	OIL	3	MOUSE?	1	NAPKINS?	3
CAT	3	SPOONS	1			AVOCADO?	1
		GARBAGE	3			SPOONS?	1
		GARLIC	3			COKE?	1
		FORK	1			PEPPER?	1
		COKE	19				
		SALT	1				
		PILLOW	1				

Term Properties		Common Noun Properties		Negative Element	
TIRED?	3	BLUE?	1	NO	6
BYE-BYE	3	RED	2		
		YUCH	1		
		UH-OH	16		
		HOT	10		

Proto-transitives		Postnominal CN-Properties		Categorical Counterexamples	
STIR?	1	ALL-GONE	6	STAN'S	5
COOK?	2	DIRTY	2	SHANNON'S	1
TASTE	1	COOL	3	GOOD	1
				ONE?	1

Two-Word Utterances

Genitive		Relational Genitive		Relective Negation	
SHEILA HAND	2	SHEILA ALL-GONE	1	NO COKE	2
SHEILA HEAD	1	SHANNON ALL-GONE	1		
SHANNON PLATE	5			Denial Negation	
STAN'S PEPPER	3	Relational Prototransitive		NO HOT	4
SHANNON COKE	2				
MY PEPPER	2	MAKE PINK	1	Agentive Negation	
Term Specification		Common Noun Specification		NO WALKING	1
MAMA BYE-BYE	1	FOUR TEASPOON	1		
		UH-OH HAND	2		
Postnominal Specification		RED FINGER	2	Combinatorial Counterexamples	
COKE ALL-GONE	1	UH-OH COKE	23		
COKE DOWN	4	UH-OH POOP	1	TUNA FISH	2
TOWEL OFF?	3	NEW PILLOW	1	SALT PEPPER	1
TOWEL ON	2	GREEN ONES?	1	WHERE EARTH	1
SALT ALL-GONE	1			A TABLE	1
TRAY DIRTY	1	Relational CN-Specification		TO TABLE	1
				ALL RIGHT	1
Prototransitive		UH-OH RED	7	READY EAT	1
				COKE MAMA	1
COOK THAT	9			UH-OH CAT	1
COOK IT	2			HEATER HOT	1
EAT NOODLES	2				
SET TABLE	1				

Three-Word Utterances

Genitive		Term Specification		Denial Negation		Combinatorial Counterexamples	
SHEILA PLAY-DOUGH	4	MAMA COME-BACK	16	NO PILLOW WET	3	DID SHANNON POOP	1
		MAMA COME-BACK?	13	NO SHOE DIRTY	1	UH-OH DROPPING COLORS	1
Prototransitive		DADDY COME--	1			SHANNON PLATE THERE	1
		DADDY-- COME-BACK	1				
SHANNON DO POOP	1	PAPA COME-BACK	1	Agentive Negation		Four-Word Utterances	
SHEILA PUMP IT	1	SHANNON COME-BACK	1				
SHEILA PUMP IT?	6			NO TOUCH IT	2	Combinatorial Counterexamples	
SPILL SOME SALT?	2			NOT TOUCH IT	2		
POUR COKE MORE?	1					ONE CUP OF SALT	2
						MAMA COMING BYE BACK	1

3.42 Language sample:

Shannon; 23 mo 9 da

CATEGORIZATION OF ALL INTELLIGIBLE UTTERANCES AND FREQUENCIES OF THEIR OCCURRENCE IN SAMPLE
10 November 1976

3.43 Grammar: Shannon; 23 mo 9 da

Lexicon of Basic Expressions

Common Nouns	:	$t//e$	: ... , THAT , IT , ...
Neg Element	:	t/t	: NO , NOT
Prototransitive	:	$(t/e)/(t//e)$	: COOK , SPILL , DO , ...
Postnominal CN Specifiers	:	$(t//e)/(t//e)$	: ALL-GONE , DIRTY , ...
CN Determiner	:	$(t//e)//(t//e)$	: SOME

Syntax of Phrase Structure					Examples
S17	t	→	t/t	t/e	NO TOUCH IT
S18	t/e	→	$(t/e)/(t//e)$	$t//e$	[EAT NOODLES$_{t/e}$]
S19	$t//e$	→	$t//e$	$(t//e)/(t//e)$	[COKE ALL-GONE$_{t//e}$]
S20	$t//e$	→	$(t//e)//(t//e)$	$t//e$	SPILL[SOME SALT$_{t//e}$]
S21	$(t/e)/(t//e)$	→	COOK , SPILL , DO , ...		
S22	$(t//e)/(t//e)$	→	ALL-GONE , DIRTY , ...		
S23	$(t//e)//(t//e)$	→	SOME		

Semantics of Logical Translation		Example Symbolization
T9	$\forall z \forall u\ [\gamma(\hat{}u)]$	$\forall z \forall u\ [\text{COOK}'(z_1)(\hat{}u)]$
T13	$\ldots , z_n , z_n , \cdots$	
T17	$\forall z \forall u\ [\gamma(\hat{}u) \wedge \zeta\ u = u_n]$	$\forall z \forall u\ [\text{TOUCH}'(z_1)(\hat{}u) \wedge \neg\ u = u_1]$
T18	$\lambda x\ [\eta(\beta)(x)]$	$\lambda x\ [\text{EAT}'(\text{NOODLES}')(x)]$
T19	$\lambda x\ [\vartheta(\beta)(x)]$	$\lambda x\ [\text{ALL-GONE}'(\text{COKE}')(x)]$
T20	$\lambda x\ [\iota(\beta)(x)]$	$\lambda x\ [\neg \wedge z_1\ [\text{SALT}'(x) = z_1(x)]]$
T21	COOK' , SPILL' , w_n , ...	

T22 ALL-GONE' , DIRTY' , ...

T23 $\lambda \underline{z} \lambda \underline{x} [\neg \wedge \underline{z}_n [\underline{z}(\underline{x}) = \underline{z}_n(\underline{x})]]$

During the intervening week since the last sample, Shannon had added complexity to her noun phrase structure and extensional relations between semantical types and a wider application of the negative. Much of the conversational redundancy is lessening as more variety of sentences are available to her. Unlike the last change in the grammar where an older form of term specification was replaced by a newer reordered form, the changes in this grammar involve the phase-like addition of of more structural abilities with additional categories.

The distinction between a common noun, t//e , and an intransitive predicate, t/e , is purely a syntactical distinction as the two forms share the same semantical type, extensionally: sets of individual concepts. The major development in this 3.43 grammar seems to underscore this categorial treatment. First, the negative rule, S17 , is the same semantical treatment as the earlier t//e negation, but now it is applied to the intransitive t/e category, and this seems reasonable given this categorial double-slash distinction that their negations be uniform in the semantical component. As such, this negation does not represent new knowledge, but generalization in a more uniform manner consistent with categorial principles. Secondly, the new noun modifying categories also have a common categorial definition, each differing syntactically from the others by the number of slashes, making their structures distinct while they share the same semantical type. The prototransitive, the postnominal, and the determiner are all extensional relations between properties of individual concepts and sets of individual concepts.

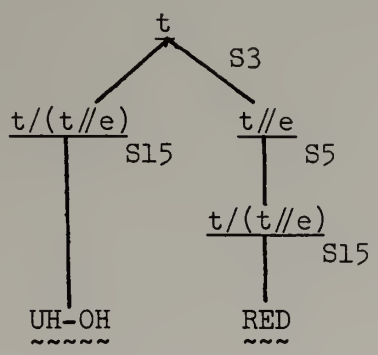
This suggests that Shannon learned the semantical relation which serves as a basis for this syntactical group so that their emergence is simultaneous.

The prototransitive is so named because its stock of words are those which will eventually reanalyze into transitive predicates, but the present relation is not yet so developed. For a true transitive relation, the same kind of lexical item must be able to serve as either the subject or direct object of the sentence. With this prototransitive, however, it is clear that only terms can occupy the subject role and common nouns fill the accusative. Subsequent development of the determiner role will be needed to provide the syntactical operation by which common nouns can be treated as full term phrases. As mentioned earlier, the distinction between terms and common nouns seems syntactically very clear from distributional data, but the semantical basis does not seem to correspond to any natural kind. The term category contains some lexical items, like MAMA and DOGGIE , which at some later point will require reanalysis into common nouns rather than being the individual denoting expressions as terms. The determiner category in English is customarily given this semantical treatment which denotes a particular individual within the noun set when a specific naming expression for that individual is not available. The definite determiner picks out a single individual within the set of the noun it is attached to. Shannon's language at this time does not have the syntactical ability to definitely determine a noun phrase, although much of the developmental activity surrounding the noun suggests that such a hypothesis is not far removed.

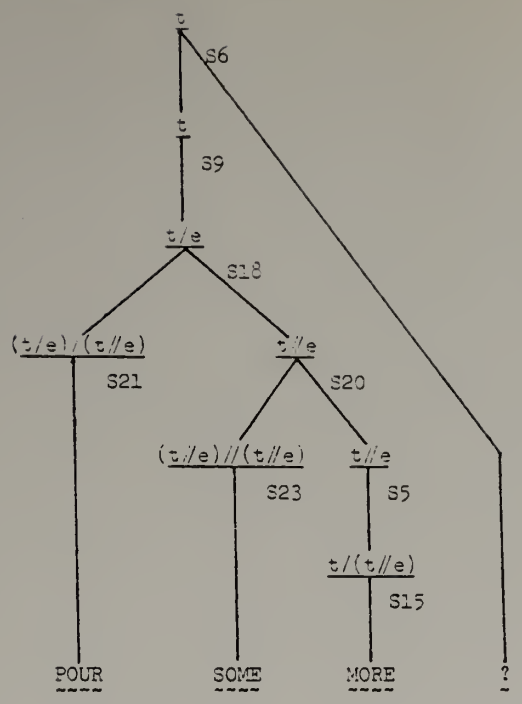
The 3.43 treatment of SOME as a determiner is rather too speculative, based as it is upon so few examples. It is not out of line to suggest that some of the early acquired words have primarily semantical meanings-- that is, they carry compositional information concerning some other semantical composites and do not have a direct model-theoretical intrepretation independent of those other composites. Most of the other categories in the lexicon carry expressions which are logical constants that are unanalyzable at the translation level of the grammar except this new determiner category in which a lexical item enters the logic with an analyzed meaning. SOME is here given a 'not all' meaning. Klein (1977) suggests a similar treatment for MORE as $\forall \underline{x}\ [\beta(\underline{x}) \wedge \forall \underline{y}\ [\beta(\underline{y}) \wedge \neg\ \underline{x} = \underline{y}]]$, meaning that there must be at least one other β for the expression MORE β to be true. ALL-GONE might also suggest itself for a semantical treatment of this class, rather than an unanalyzed constant; perhaps $\forall \underline{x}\ [\beta(\underline{x}) \wedge \neg\ \forall \underline{y}\ [\beta(\underline{y}) \wedge\ \underline{x} = \underline{y}]]$ given the meaning opposite of Klein's MORE . This kind of treatment for the determiners is a natural consequence of this form of metalanguage permitting translation into the level of intensional logic. Finding empirical support for such speculations is difficult since eliciting a consistent performance from young children is known to be something of a problem (Roeper and Matthei 1974). The method suggested here assigns words like SOME , MORE , ALL-GONE different meanings in the semantical component by entailing extra logical expressions, although there are general evidence (Fodor, Fodor, and Garrett 1975) that a uniform treatment for all words as unanalyzed logical constants is justified upon psychological grounds. There cannot be much resolution of this point right now, and so both methods should

be generally known. Although the lexicon presently allows items which are constants or variables in a single category, it is probably best to syntactically distinguish those which contain analyzed compositions even if the distributional evidence for this distinction is weak.

3.44 Relational constructions: analysis trees and derivations.



i.	φ	exponent
ii.	$\forall \underline{z} \forall \underline{u} [\beta(\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z})]$	by T3
iii.	$\forall \underline{z} \forall \underline{u} [\lambda \underline{x} [z(x) \wedge \delta(\hat{}\underline{z})] (\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z})]$	by T5
	$\forall \underline{z} \forall \underline{u} [\underline{z}(\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z}) \wedge \delta(\hat{}\underline{z})]$	λ-convert
iv.	$\forall \underline{z} \forall \underline{u} [\underline{z}(\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z}) \wedge \underset{\sim\sim\sim\sim\sim}{\text{UH-OH}}'(\hat{}\underline{z})]$	by T15
v.	$\forall \underline{z} \forall \underline{u} [\underline{z}(\hat{}\underline{u}) \wedge \underset{\sim\sim\sim}{\text{RED}}'(\hat{}\underline{z}) \wedge \underset{\sim\sim\sim\sim\sim}{\text{UH-OH}}'(\hat{}\underline{z})]$	by T15



i.	φ		exponent
ii.	?		by T6
iii.	$?\forall\underline{z}\forall\underline{u}$	$[\gamma(\hat{}\underline{u})]$	by T9
iv.	$?\forall\underline{z}\forall\underline{u}$	$[\eta(\beta)(\hat{}\underline{u})]$	by T18
v.	$?\forall\underline{z}\forall\underline{u}$	$[\eta(\iota(\beta))(\hat{}\underline{u})]$	by T20
vi.	$?\forall\underline{z}\forall\underline{u}$	$[\eta(\iota(\lambda\underline{x}\,[\underline{z}(\underline{x}) \wedge \delta(\hat{}\underline{z})]))(\hat{}\underline{u})]$	by T5
vii.	$?\forall\underline{z}\forall\underline{u}$	$[\underline{\text{POUR}}'(\iota(\lambda\underline{x}\,[\underline{z}(\underline{x}) \wedge \delta(\hat{}\underline{z})]))(\hat{}\underline{u})]$	by T21
viii.	$?\forall\underline{z}\forall\underline{u}$	$[\underline{\text{POUR}}'(\lambda\underline{z}\lambda\underline{x}\,[\neg\wedge\underline{z}_1\,[\underline{z}(\underline{x}) = \underline{z}_1(\underline{x})]](\lambda\underline{x}\,[\underline{z}(\underline{x}) \wedge \delta(\hat{}\underline{z})]))(\hat{}\underline{u})]$	by T23
	$?\forall\underline{z}\forall\underline{u}$	$[\underline{\text{POUR}}'(\lambda\underline{x}\,[\neg\wedge\underline{z}_1\,[\lambda\underline{x}\,[\underline{z}(\underline{x}) \wedge \delta(\hat{}\underline{z})](\underline{x}) = \underline{z}_1(\underline{x})]])(\hat{}\underline{u})]$	λ-convert
	$?\forall\underline{z}\forall\underline{u}$	$[\underline{\text{POUR}}'(\lambda\underline{x}\,[\neg\wedge\underline{z}_1\,[[\underline{z}(\underline{x}) \wedge \delta(\hat{}\underline{z})] = \underline{z}_1(\underline{x})])(\hat{}\underline{u})]$	λ-convert
	$?\forall\underline{z}\forall\underline{u}$	$[\underline{\text{POUR}}'(\neg\wedge\underline{z}_1\,[[\underline{z}(\hat{}\underline{u}) \wedge \delta(\hat{}\underline{z})] = \underline{z}_1(\hat{}\underline{u})])]$	λ-convert
ix.	$?\forall\underline{z}\forall\underline{u}$	$[\underline{\text{POUR}}'(\neg\wedge\underline{z}_1\,[[\underline{z}(\hat{}\underline{u}) \wedge \underline{\text{MORE}}'(\hat{}\underline{z})] = \underline{z}_1(\hat{}\underline{u})])]$	by T15

The relational constructs are among some of the most interesting examples in the corpus of this period. On the surface level these sentences appear to have missing nouns as their interpretations must clearly involve sets of individual concepts in some manner. The use of the variables and lambda-abstraction provides as elegant derivation for this class of sentence types without syntactical deletions, covert lexical items, or performance limitations. It may seem that lambda-abstraction is too complicated for beginning compositional logics of such small children. Much of this counterintuitiveness when first encountered may be due to the unfamiliarity of formal semantics-- lambda-abstraction is needed to connect the most plausible syntax to a model interpretation and it is really no more complex than other methods, such as Bloom's obligatory transformation.

The sentence, UH-OH RED , is the earliest occurrence of a relational common noun specification. It is good to encounter such examples since its form is predictable from the first 3.20 grammar although no such actual example was found in earlier samples. This kind of difference in chronological sampling does not have much acquisitional import, but it does give some measure of confidence to the details of the grammar construction. The discovery of predicted types not only make the analysis somewhat simpler as it progresses over chronological depth since all new forms will not need new rules; but it also increases the certainty of the previous analysis in a post hoc manner. Once acquisition begins through a series of samples, it becomes apparent what the best analysis for the beginning of the series should be, but not necessarily for the end of it. The discovery of predicted forms gives some confi-

dence, and subsequent development upon an older form also imparts more certainty to earlier analytical results.

The sentence, POUR SOME MORE , is one of the most complicated of semantical derivations in these samples, largely because of the above-mentioned speculative meaning assigned to SOME with its double lambda-abstracts. This example does illustrate the continued use of the holoprastic part of the grammar, in this case S9-T9, to permit the newly acquired prototransitive phrase to be interpreted on its own. Previous formal treatments of early child syntax have left the continued holophrastic utterances as something of an unexplained phenomenon and these examples are usually dismissed from the data a priori. The rules of holophrase interpretation, however, are a very powerful set of devices and continue to characterize many of the sentences being offered by Shannon in conversation. The holophrase rules do not lessen in importance but continue to play an important interpretive role with newly acquired phrases. To discard them at this stage would be loss to consistent formal treatment of the child's language.

One-Word Utterances

Terms

RONNIE	2
DADDY	10
SHANNON	1
DADA	1

Common Nouns

PENCIL	1
CRAYONS	3
FIRE	1
APPLE-JUICE	4
CUP	4
BLOCKS	1
TRIANGLE	13
HORSE	14
COW	6
HAIR	1
BLOCK	2
CAR	2
PAPER	1
COFFEE	5
SHOE	8
SHOES	1
PUZZLE	2
RINK-A-ROSIE	8

Term Properties

UP	1
SAYING	1

Common Noun Properties

TWO	2
UH-OH	9
LITTLE	2
HOT	2

Negative Element

NO	2

Categorical Counterexamples

SHANNON'S	1
DADDY'S	1
MUSIC	1

Proto-transitives

FOLDED	4

Postnominal CN-Properties

BROKEN	1
ALL-GONE	2
BOOM	3

Categorical Counterexamples

SHANNON'S	1
DADDY'S	1
MUSIC	1

Two-Word Utterances

Genitive

MOMMY GROCERY	1
SHANNON APPLE JUICE	1
MOMMY'S CAR	5
DADA PECES	3
DADA THAT	1
DADA PAPER	1

Term Specification

SHANNON TIRED	1
DADDY TIRED	1
MOMMY TIRED	1

Prototransitive

WRITE PAPER	4
TIE SHOE	5
KNOCK OVER	4
FOLD UP	1
FOLD OFF	2
FOLD IT	2
FOLD ON	1
TOUCH PAPERS	1
TOUCH HEATER	1
TOUCH IT	1

Common Noun Specification

THIS PAPER	1
TWO BLOCKS	2
BIG BLOCK	6
BIG ONE	2
LITTLE BLOCK	6
TWO HORSE	2
UH-OH COW	2
TEN MINUTES	1
UH-OH PAPERS	2

Postnominal Specification

MILK ALL-GONE	2
COFFEE ALL-GONE	3

Rejective Negation

NO JUICE	1

Denial Negation

NO HOT	1

Agentive Negation

NO COOKIN	1

Prototemporal

HAIR TRIANGLE	1
TAPE RECORDER	4
TRIANGLE PUZZLE	1

Counterexamples

THANK YOU	1
HOW'S THAT	1
ALL FOLDED	1
ALL FOLDED?	1
MOMMY DADA	1
DADDY DADDY	1

Three-Word Utterances

Prototransitive

MAMA COOKIN DINNER	1
DADA COOKA DINNER	1
HELEN DO IT	1
SHANNON TAKE NAP	1
DADDY FOLD IT	2
YOU FOLD IT	1
FOLD IT UP	1
FOLD UP RINK-A-ROSIE	1
DADA FOLD THAT	5
DADA FOLD IT	1
SHANNON DRANK IT	1
SHANNON GET PAPERS	1

Agentive Negation

NO COOKIN DINNER	1
NO COOKA DINNER	1

Prototemporal

PAPER IN THIS	3
PAPER IN HERE	1
HAIRS ON TRIANGLE	1

Combinatorial Counterexamples

HERE'S YOUR BLOCKS	1
CUP JUICE SHANNON	1
ON IT DADA	1
DADA HOME SHANNON	1
MAMA HOME SHANNON	1
HORSE GO BOOM	1

Four-Word Utterances

Prototransitive

DADA WORK ON CRAYONS	1
DADDY PLAY WITH BLOCKS	2
DADDY PLAY WITH TRIANGLE	1

Combinatorial Counterexamples

NO TAKE A NAP	1

3.45 Language sample: Shannon; 23 mo 26 da

CATEGORIZATION OF ALL INTELLIGIBLE UTTERANCES
AND FREQUENCIES OF THEIR OCCURRENCE IN SAMPLE
21 November 1976

3.46 Grammar: Shannon; 23 mo 26 da

Lexicon of Basic Expressions

Terms	:	$\underline{e}$	:	... , YOU , ...

Syntax of Phrase Structure					Example
S24	$\underline{t/\!/e}$	→	$(\underline{t/\!/e})/(\underline{t/\!/e})$		FOLD UP
S25	$\underline{t/\!/e}$	→	$\underline{t/\!/e}$	$\underline{t/\!/e}$	HAIR TRIANGLE

Semantics of Logical Translation		Example Symbolization
T12	... , $\underline{u}_n$, ...	
T24	$\lambda\underline{x}\,[\vartheta(\underline{z})\,(\underline{x})]$	$\lambda\underline{x}\,[\underline{UP}'(\underline{z})\,(\underline{x})]$
T25	$\lambda\underline{x}\,[\beta(\underline{x}) \wedge \beta(\underline{x})]$	$\lambda\underline{x}\,[\underline{HAIR}'(\underline{x}) \wedge \underline{TRIANGLE}'(\underline{x})]$

During this last seventeen day interval, there does not seem to be much developmental activity. The conversion rule for postnominals, S24-T24 , allows these specifiers of common nouns to behave as nouns in the syntax by relying on the interpretation of $\underline{z}$-variables in place of the noun. This is much the same treatment given common noun properties in T5, and it doesn't represent radically new knowledge. Indeed, a more general notion of phrase structure predicts that all noun-modifying categories would have a generalized ability of operating upon semantical $\underline{z}$-variables in place of a specified lexical entry. If this were tested out and found to be the case, then a Δ-dummy could be placed in the lexicon rather than requiring a conversion rule in the syntax for each of the categories.

The rules, S25-T25, concerns a curious construction, here called the protorelative. Again, this analysis is rather speculative, there being so few examples encountered at the end of this series so that subsequent development cannot be cited in its favor. Interest in its grammatical form is in finding evidence for a new ability which is likely to put an empirical stress on Shannon's present stage of grammar. The HAIR TRIANGLE and TRIANGLE PUZZLE examples are the first phrases which can be interpreted with two members of the same category appearing in the same construction. Since TRIANGLE appears in both examples in either ordered position, it contains a minimal contrast indicating some productivity for this construction. The semantical intuitions for these sentences do not, however, exactly agree with the interpretation given in T25. From the transcript it seems that the noun in second position is modifying a head noun in the first position. HAIR TRIANGLE is referring to a hair, and TRIANGLE PUZZLE is referring to a triangle. The simple conjunctive meaning given in T25 does not specify that the latter noun is important only to signify a particular instance of the former noun. If this modifying-head intuition were tested out, it would probably be evidence for introducing a two-place function in the intensional logic, rather than the more conservative meaning given in T25. Two-place functions take two arguments of the same type, and this is the kind of knowledge Shannon will need to stage-change the basic structure of her present grammar.

The counterexamples in some of the samples contain specimens of similar constructs with both words of the same category. * MAMA SHEILA in 3.40 and * MOMMY DADA or * DADDY DADDY in this sample have two

term expressions in the same construction; however, these examples were completely uninterpretable to those who spoke with Shannon. It is very doubtful that either of the terms in these counterexamples could be properly considered a head, while the TRIANGLE examples appear to have such interpretation.

3.5 A summary may be here helpful. The grammatical analysis as defined in section 2.0 has been applied to historical material of some descriptive methods from Braine (1963) and Bloom (1970) to illustrate the relationship between those more familiar approaches to child language and the one introduced here. The major improvements in analysis are primarily the result of an explicit semantical component which is capable of work on its own-- thereby simplifying the work of phrase structure. By analyzing the developments of Shannon through the month of syntactical emergence in productive ability, the descriptive method seems particularly successful in capturing the integration of her genitive and rejective negation, but also assigning a compositional relationship between rejection and denial. It is nice to have a grammar which accounts for the holophrastic interpretation in a specifiable manner in the same kind of rules as the early combinatorial abilities. Shannon's intensional replacement sequence and the model structure it specifies are extraordinary because it fits so naturally in Montague grammar and these structures apparently have been unnoticed by other researchers relying on situational pragmatics to determine child semantics. About a third of all Shannon's conversational utterances exercise intensional interpretation in some degree. The treatment of subsequent development suggests the acquisition of syntactical rules as discrete

mental objects, but the method of synchronic description used here as elsewhere needs to be replaced by diachronic methods which specify how a grammar changes in relation to linguistic data. A more complete map of a child's language through major stage-changing in the grammar could help with the introduction of diachronic methods.

The next section attempts to plunge into the formal treatment of language disability by distinguishing delay, disorder, and deviation. Only language delay is relatively uncontroversial in clinical literature on the topic, but a simple disorder is easy to establish with more data and it does not introduce additional problems for the descriptive method. The distinction between complex disorder and deviation is the most difficult matter to be attempted in the next section.

4.0 Grammatical Description of Language Disability

Not all children learn language in the same manner; indeed, some never learn it at all. It is the goal of this section to provide a formal treatment for some simple case studies of people who are severely disabled in communication. An advantage to this method of description is the central focus on how the target language is structured to compose meanings. Most clinical approaches to communications-disabled clients attempt to describe a disability by what is missing in their languages: errors, omissions, substitutions, and the like. In the standard psychometric assessment, the client's performances are compared to the structure of a statistical standard of a normal population-- that is, a population with disabled people removed or, at best, with the disabled in the population in accordance with their prevalence. While there is some

advantage to these statistical standards, they do not provide adequate description of the client's language as they focus upon some social standard for grammar of the community rather than the grammar of the client. Indeed, many of the basic questions on the psychological nature of language cannot be answered by social standards since the boundaries of 'normal' differ from society to society, and the issues of psychological abilities must consider the entire biological populations rather than the social standards of particular communities. Direct inquiry into the language structure of mentally disabled individuals has been attempted from time to time, but formal treatments have been fragmentary or glossed into vague terms. It is unfortunate that it has become rare to find a complete set of the unrefined data so to verify the claims of disability or to suggest better alternative forms of structural analysis. It is doubtful that theraputic efforts or efficient prosthesis can be designed without a proper analysis of a client's language, especially when the language may be very different from that expected by the local community.

Language disabilities are generally thought to exist in three forms-- delays, disorders, and deviations-- although the technical demonstration of these distinctions is still rather speculative. A language delay proceeds through the same acquisitional patterns as children who learn it in the usual manner, but delayed learning begins later, makes slower progress, and terminates with a less-than-usual level of adult competence. Delays are frequently referred to in relation to mental retardation, educational subnormality, and extremely disadvantaged environments. A language disorder is properly characterized by the same

rules of grammar as the general community, but they interact inappropriately and thereby fail in communication. The development of a language disorder in childhood is uneven when compared to the normal population, sometimes characterized by periods of regression. Disorders are usually diagnosed in relation to emotional disturbances, organic pathologies of the nervous system, and traumatic injuries of the brain. It is common in cases of language disorder to suspect that a client possesses greater intellectual competence than is being expressed in the disordered performances. Language deviations have rules of the grammar unlike those of peer or community. A child with a deviant language fails to communicate because there is some qualitative difference in grammatical ability. Deviantly-speaking children are often observed to develop language in the usual manner to an early stage and then remain acquisitionally stationary for a long period.

Most language delays and some of the simpler disorders in children are probably related to performance features of the mental system: the amount of memory available; unstable performance; or unique restrictions on input data for learning. These seem to be problems of the brain, its physiology, or of extreme environments. Some of the more complex disorders-- usually associated with personality disturbances or childhood psychosis-- and language deviations may be more directly related to mental competence rather than brain performance. These problems are related to forms of knowledge, the nature of that which is believed to be true, inference capacities, and so on. These are the problems of the mind.

Menyuk (1963) provides one of the earliest attempts to formally describe language disabilities. Her clinical procedure combined psycho-

metrics and an early form of transformational syntax, distinguishing a population of children by age and disability. Since this time, greater numbers of language diagnostic techniques have attempted to measure the development of a child's syntactical abilities with an analysis of some linguistic performances. Menyuk (1964, 1969) initiated a discussion on the nature of language deviations in childhood. Through the analysis of sentences taken from transcripts, Menyuk compared vocabulary-matched groups of deviantly-speaking children with groups of younger normal children. These studies presented only a very few actual sentences selected to illustrate her grammar. Without a complete set of transcripts, it is difficult to verify that the deviantly-speaking group actually did so. In discussion of the Menyuk scoring protocols, it is concluded that the deviantly-speaking children were not merely delayed in their language development, but there appeared to be qualitative difference in their linguistic abilities. Likewise, Lee (1966) compared the transcripts (also not available)of two children and determined that one of the children was not just delayed in development but failing to make some linguistic generalizations upon which syntactical development depends. The Menyuk-Lee type of structural psychometrics initially concluded that it may be the case that some children do not follow the normal pattern of development.

Morehead and Ingram (1973) introduce a counterhypothesis into the discussion of deviant language development. Their hypothesis of quantitative deviance states that all children develop similarly constructed linguistic systems, although some are noticeably delayed in acquisition. The nature of their argument qualitative deviance seems to involve the

frequency of phrase structure rules and 'forty different transformations' which are found to be similar for a deviantly-speaking group although delayed from the normal group. Again, the problems in understanding these conclusions stem from the failure to present a formal of both data and grammar of even a single language sample. The forty transformations are particularly suspect as a grammar of this size is a complicated formal object and the Morehead-Ingram study claims to have produced thirty of them. A transformational component of this size suggests that the form of the phrase structure may be at fault, resulting in the similarities found in the samples. Nevertheless, it was concluded that linguistically-deviant children develop grammar similar to normal children, but their acquisition is markedly delayed in onset, and their progress is otherwise quantitatively different from normal. Lee (1974) curiously reverses the original conclusion of developmental sentence-type analysis by stating that it '... does not bring out qualitative differences between normally developing children and language delayed children.'

Menyuk (1973) continues to cite differences found in vocabulary-matched groups of children to indicate qualitative distinctions in deviant language. Her arguments, however, are subject to very general criticism on the psychometric use of surface structure testing and its inabilities to determine qualitative deviance. Although Morehead and Ingram (1973) claim they used generative techniques for grammar construction, most other researchers into deviant language have used psychometric methods which uses some rules of standard English grammar and then searches the data for sentences which show such rules as part of

their derivation. This method is taken to be successful if it gives statistical distinctions between groups of children with communication problems from the viewpoint of clinical specialists and groups from the general population. The Menyuk-Lee type analysis may be able to pick the problem children without distinguishing those structural qualities of deviance within their language. As such, language tests of the sort being used in language assessment are, at best, screening instruments because they do not have the ability to specify structural differences in grammars. A client's grammar may contain very different rules from those in the psychometric test and yet converge in some degree upon the same set of surface markers.

4.1 Clinical language samples are collected from people who are disabled in the task of communicating with others and it is the goal of the language clinician to provide an analysis of how the client's grammar puts words together into sentences found in the sample. This study will give three language samples-- two from a typical clinical setting in which a clinician meets with the client for the purpose of collecting a sample of language abilities, and the third from a school setting in which a teacher prepares daily written exercises for a handicapped student. All three clients are adolescents whose simple language abilities are stable-- subsequent acquisition of major new abilities is not probable. The grammars given in this section may be close to their adult level of communication. It would, of course, require a chronological sequence of data to establish that a grammar is stable or changing, but chronological depth in sampling is unusual in clinical psychology. Most diagnostic procedures are based upon one-time measurements which result

directly in or contribute to prognosis. Even in long-term facilities, there are few psychometric procedures which require evidence of mental change over a period of objective sampling. The next two language samples are the kind of first referral information available in many case conference proceedings, but it is rare to see the actual samples of what the client says.

The first sample of Janice, when she was almost twelve, is an example of language delay. The grammar, 4.11, is in respects like the grammar of younger children. The sample of 12-year-old Tyrome, 4.13, is a simple disorder, probably not too disimilar in etiology from the language of Janice. The grammar of John, 4.21, is given as an illustration of language deviation, although it may indeed represent a complex disorder. The appendices contain all of the raw data used for the these studies of disability.

4.10 Language sample: Janice; 11 yr 10 mo 15 da
11 yr 11 mo 7 da

Nouns		Protoverbs		Adjectives		Truth Functions		Categorial Counterexamples	
SUN	1	GO	1	BLACK	4	NO	8	SUSAN	3
DOLLY	2	WASH	1	PURPLE	4	YEA	8	HI	1
SHIRT	4	LIKE	1	PINK	1	YEP	1	OH	1
WATER	1	BRUSH	1	RED	1	UM-HUM	1	OUCH	1
ROOM	1			ALL-GONE	2	YES	1	UM	1
YARD	1							UH	1
								WHAT	18

Locatives		Adverbial Particle		Predicates	
WRITE ON A PAPER	1	GO AWAY	2	GO SHIRT	1
IN YARD?	1	COME ON	1	TAKE SHOE	1
OUT IN YARD?	1	TAKE OFF	1	DRY DOLL	2
IN THE YARD?	1	PUT SHOE ON	1	COMB HAIR	1
HERE ROOM	1	PUTTING PANTS ON	1	DRAWING THE PURPLE	2
		TAKING PANTS ON DOWN	1		

Attribution		Modification		Nonexistence Negation	
THAT'S PURPLE	1	WHITE SKIRT	1	NOT DADDY	1
THAT PURPLE	1	RED SKIRT	1	NOT RAINING	2
SOCK ALL-DONE	1	PURPLE SHIRT	1	NO PULL	1
YOU A GOOD GIRL	1	ALL-GONE RAIN	1	NOT COMB	2
SUN OUT	1			NOT PURPLE	2
RAINING OUT?	1			NOT BLUE	1
SHIRT ON	1			NOT PINK	2
COMB AWAY	2			NO WHITE SKIRT	1
				NO PINK DRESS	1
				NO LONG DRESS	1
				NO WASH TABLE	1

Aspectuals

SKIRT TOMORROW?	1
NO PURPLE SKIRT TOMORROW	1
GET OVER THERE RIGHT NOW	1
YOU GET OVER THERE RIGHT NOW	1
YOU STOP THAT RIGHT NOW	1

Possibility Assertion

MAYBE SKIRT TOMORROW	1

Combinatorial Counterexamples

TOO BAD	6	RIGHT THERE	1
TOO HOT	1	WHAT JANET	1
THAT'S IT	3	SUSAN NO COMB	1
TOMORROW SKIRT	1	NO COMB FOR SUSAN	1
SHIRT UNDERPANTS	1		

4.11 Grammar: Janice; 11 yr 10 mo 15 da
11 yr 11 mo 7 da

Lexicon of Basic Expressions

Sentences	: t	: S	:	
Terms	: e	: T	:	YOU
Common Nouns	: t//e	: N	:	THAT , SKIRT , COMB , ···
Verb Phrases	: t/e	: VP	:	
Protoverbs	: (t/e)/(t//e)	: PVB	:	PUT , TAKE , COMB , ···
Adjectives	: (t//e)/(t//e)	: ADJ	:	RED , ALL-GONE , GOOD , ···
Locatives	: (t/e)/(t/e)	: LOC	:	OVER-THERE , AWAY , ON , ···
Truth Operators	: t/t	: TRU	:	NO , MAYBE , YES , YEA , ···
Aspectuals	: t//t	: ASP	:	RIGHT-NOW , TOMMORROW

Syntax of Phrase Structure				Example
S1	t	→	e t/e	YOU GET OVER THERE RIGHT NOW
S2	t	→	e t//e	YOU A GOOD GIRL
S3	t	→	t//e (t//e)/(t//e)	SOCK ALL-DONE
S4	t	→	t//e (t/e)/(t/e)	SUN OUT
S5	t	→	t/t t	MAYBE SKIRT TOMORROW
S6	t	→	t t//t	YOU STOP THAT RIGHT NOW
S7	t	→	t ?	RAINING OUT?
S8	t/e	→	(t/e)/(t//e) t//e	GO SHIRT
S9	t/e	→	t/e (t/e)/(t/e)	PUT SHOE ON
S10	t//e	→	(t/e)/(t/e) t//e	WRITE ON A PAPER
S11	t//e	→	(t//e)/(t//e) t//e	WHITE SHIRT
S12	t//e	→	(t//e)/(t//e)	DRAWING THE PURPLE
S13	t/e	→	(t/e)/(t//e)	TAKE OFF
S14	t	→	t/e	GO
S15	t	→	t//e	SUN
S16	t	→	t/t	YEA
S17	e	→	YOU	
S18	t//e	→	THAT , SKIRT , COMB , ...	
S19	(t/e)/(t//e)	→	PUT , TAKE , COMB , ...	
S20	(t//e)/(t//e)	→	RED , ALL-GONE , GOOD , ...	
S21	(t/e)/(t/e)	→	OVER-THERE , AWAY , ON , ...	
S22	t/t	→	NO , MAYBE , YES , YEA , ...	
S23	t//t	→	RIGHT-NOW , TOMORROW	

Semantics of Logical Translation		Example Symbolization
T1	$\forall z \forall u$ [VP(^T)]	$\exists N \forall z \forall u$ [OVER-THERE'(^GET')(^u)]
T2	$\forall z \forall u$ [N(^T)]	$\forall z \forall u$ [GOOD'(^GIRL')(^u)]
T3	$\forall z \forall u$ [ADJ(^N)(^u)]	$\forall z \forall u$ [ALL-DONE'(^SOCK')(^u)]
T4	$\forall z \forall u$ [LOC(^N)(^u)]	$\forall z \forall u$ [OUT'(^SUN')(^u)]
T5	TRU [S]	$\exists W \forall z \forall u$ [SKIRT'(^u)] $\vee \neg \exists W \forall z \forall u$ [SKIRT'(^u)]
T6	ASP [S]	$\exists N \forall z \forall u$ [STOP'(^z)(^u)]
T7	? [S]	$?\forall z \forall u$ [OUT'(^RAINING')(^u)]
T8	PVB(^N)	$\forall z \forall u$ [GO'(^SHIRT')(^u)]
T9	LOC(^VP)	$\forall z \forall u$ [ON'(^PUT'(^SHOE'))(^u)]
T10	LOC(^N)	$\forall z \forall u$ [WRITE'(^ON'(^PAPER'))(^u)]
T11	ADJ(^N)	$\forall z \forall u$ [WHITE'(^SHIRT')(^u)]
T12	ADJ(^z)	$\forall z \forall u$ [DRAWING'(^PURPLE'(^z))(^u)]
T13	PVB(^z)	$\forall z \forall u$ [OFF'(^TAKE'(^z))(^u)]
T14	$\forall z \forall u$ [PVB(^z)(^u)]	$\forall z \forall u$ [GO'(^z)(^u)]
T15	$\forall z \forall u$ [N(^u)]	$\forall z \forall u$ [SUN'(^u)]
T16	TRU [S"]	$\forall z \forall u$ [UNZIPPING"(^DRESS")(^u)]

where S' is part of the presuppositional common ground and S" is the result of operating TRU on S'.

T17	u
T18	z , SKIRT' , COMB' , ...
T19	PUT' , TAKE' , COMB' , ...
T20	RED' , ALL-GONE' , GOOD' , ...
T21	OVER-THERE' , AWAY' , ON' , ...
T22	λP [$\neg$ P] , λP [P $\vee \neg$ P] , λP [P] , λP [P] , ...

T23 $\lambda\underline{P}\ [\underline{N}\ \underline{P}]$, $\lambda\underline{P}\ [\underline{W}\ \underline{P}]$

A differential diagnosis of language delay technically requires evidence of: (i) a delayed beginning of whatever linguistic ability is being measured; (ii) slower progress through a typical acquisition pattern; and (iii) developmental termination at a level less than the usual adult competence. In most clinical settings, it is rare to find these data carefully documented since contemporary practice is based upon statistical comparison of performance frequencies for a few isolated structures of grammar typically found in the language of a general population of children. If cumulative records are available, it is usually the test scores and percentile rankings that is retained while the basic data of client performance is not reported. It is sometimes possible, however, to estimate delayed onset of acquisition from some anecdotal records as social workers frequently ask parents about the client's first words or a teacher might note that someone began speaking in short phrases. Slower development is the hardest to document in most clinical settings since chronological depth in data construction is very uncommon. Usually, diagnostics are scheduled in advance of an imminent case conference so a clinician is not able to continue sampling until there is an appreciable change in client performance to establish a rate in order to document slower progress. Even in long-term facilities and total institutions where years of client performance are potentially available, there is emphasis on one-trial, short-term measurements which are systematically less accurate to the cases with more extreme delay. It may seem perverse that statistical population procedures make it

harder to document the more extreme disabilities; but, by and large, the use of differential diagnosis in language disabilities is moot-- there are no effective treatments known which are differentially sensitive. The third diagnostic point is really a prognostic indication for the delayed child and can only be established after it is too late for intervention techniques to be applied in effort to enhance client development. Since puberty usually terminates the primary mental development of language abilities, the main evidence for delay is found in the synchronic analysis of an adolescent with a stable child-like language. The 4.10 Janice sample is available from a practicing language clinic and the severity of her disability can be intuitively established by direct examination of the transcript, selected to represent her most usual linguistic performances. Intuitive data should be the heart of clinical reporting, because it is as essential to validity as reproducible observation is necessary to reliability.

It may be important to notice that apparently a different ontology underlies the language which Janice uses in distinction from the model constructed for Shannon. The ontology of a grammar concerns the kinds of primitives used in the model interpretation. Shannon's language is modeled upon a distinction between terms and nouns. The intensional functions in the 3.3 model for terms are specified so MAMA is always denoting a single individual while common nouns like FECES denotes a set of individuals, sometimes being true of just SH and other times being true of others. The Shannon model is constructed with a rather parsimonious ontology where the set of possible individuals is roughly composed of real world persons-- things which can have some territorial claims

over other object-like things which lack this property of possessive ability. The intensional functions for common nouns in the Shannon ontology do not denote primitive objects uniquely but characterize sets of person-like individuals. If there were such a thing as a standard model ontology, it would include a primitive for the object-like things along with the person-like things, but this model foundation seems a bit over-extended in Shannon's case. The basic transitivity of the adult language is conspiciously absent in Shannon's language. She did not say things like *Ø SHOE DADDY meaning a shoe's father nor meaning that a shoe possessed her father. She never referred to her grandmother as *Ø DADDY'S MAMA which may have been a description offered to her, nor to herself as *Ø MAMA BABY -- although she would later learn these things at different times, they were unavailable to her present mode of speaking about the world.

The kind of Shannon model ontology does not seem to fit the sample of Janice. There are very few expressions in 4.10 which designate the people spoken about (excepting SUSAN) and there are frequent deictic expressions (YOU , THAT , RIGHT-NOW , OVER-THERE) which serve to indicate a specific pragmatic reference. This emphasis on deixis and common nouns is a basic distinction in Janice's grammar which could modeled different from the minimal ontology of the Shannon sample. The negative seems to be a good test for these distinctions-- Janice's uniform use of nonexistence negation (poorly named so) is related to the common noun deixis in much the same manner as Shannon's rejection and denials were related to the fundamental genitive distinction in her ontology. The nonexistence meaning given in T5 is probably inaccurate: NOT PURPLE should mean

$\forall z \forall u\ [\neg$ PURPLE'$(\hat{}z)(\hat{}u)]$ meaning there is something which is not purple to get the proper nonexistence interpretation. This antideictic form of negation would have to operate upon the level of verb phrases, and it would be of some type. $(t/e)//(t/e)$, to create the property of being not purple. Janice's T5 is given for its simple syntax since it is not good to complicate the grammar without enough examples to indicate the nature of the complexity.

On the matter of intensional/extensional functional structure, Janice also gives a variant perspective. If there ever was a child who spoke entirely of the here-and-now situation, Janice is close to it. With the possible exception of BRUSH if interpreted only as a noun, all of her sentences are extensionally true. She produced no false utterances with respect for real life occurrence; but even so, intensional modeling seems warrented by the frequent nonexistence negations. Her common assertion that such-and-such was not the case formally requires an intensional treatment, and often these were spontaneous negations not previously suggested by anyone. No one was likely to claim that dolly was a daddy, nor that the black pen was purple, nor that the purple dress was pink. These negatives seem to function as a minimal contrast from actual to nonactual reference while remaining extensionally true. Janice asserts NO WASH TABLE when washing the doll, contrasting possible verb objects.

These differences between Janice's ontology and Shannon's do not suggest deviation as the same kind of rules appear in both, but they are evidence of variation as to the different kinds of relations with which the early grammar begins. As discrete mental abilities, the 4.11 grammar

does not have syntactical or semantical abilities which can be put to fault. Her disability does not result from faulty mental competence but rather suggests that performance capacities have not developed much beyond this early level. Since this sample was collected across a 23 day period and there appears to be no change during the grammar as one might expect from a 12-year-old, the optimal diagnosis of language delay seems in order. If it were found that all children who developed this deictic/noun ontology were disabled in subsequent development (an unlikely hypothesis by all accounts), then a disorder might exist between this possible variant pattern of acquisition and the performance requirements of learning. The 4.11 grammar is well formed with respect to metalinguistic principles even if it were found to be ill-suited for the progress of continued development. Since Bloom reported nonexistence negatives in her child's development, the 4.11 grammar probably demonstrates variance in acquisition which terminated at an early level of competence due to limitations of the performance system. The mind be sound, but the brain be weak.

Agent		Common Noun		Prototransitive		Accusative	
PEOPLE	1	RAIN	1	FALL	1	A FEET	1
SQUIRREL	1	FINGER	2	WASH	1	THE WEEK	2
DOCTOR	5	RING	1			A SHOE	1
		CANDLE	1	Nominative		A HAND	1
		SHOW	1			A FINGER	1
		TEETH	1	THE PEOPLE	1	TWO RING	1
		BUS	1	THIS GIRL	2	ONE HAND	1
						FOUR CANDLE	1

First-Order Intransitive		Second-Order Intransitive		First-Order Prototransitive	
SQUIRREL EAT	3	HE EAT	1	BOY WEAR BOOT	4
DOCTOR WASH	1	HE FALL	2	BOY RIDING SLED	1
GIRL COOK	1	THEY EAT	1	BOY ON SLED	1
		THIS GIRL WRITE	1		
		THIS GIRL COOK	1		
		THIS GIRL EAT	2		

Intermediate Prototransitive		Second-Order Prototransitive	
HE FALL BOO-BOO	1	THE BIRD ATE HIS NEST	1
MAN DRIVE A BUS	1	THIS BOY RIDING A BIKE	1
BOY RIDING A BICYCLE	1	THIS BOY FALL A BUMP	1
BOY RIDING A BIKE	2	HE ATE IT	1
DUCK IN THE WATER	3	THIS GIRL BRUSH HER TEETH	1

Auxiliary

GO SLEEP	1	I CAN'T DO IT	1
GO PLAY	1	I CAN'T	1
I WANNA GO	1	THIS GIRL GO TO SLEEP	1
THEY GO AWAY	1	THIS GIRL GO WASH	1
HE GET UP	1	THIS GIRL GET DRESSED	1
THIS GIRL GO TO SLEEP	3	THEY GO WASH THE HANDS DISHES	1
THEY GO	1	I'M HOT	1

Nonspecified Relation		Wh-question		S-Concord Negative	
BIRD NEST	1	WHY?	1	NO I CAN'T	1
BOY COAT	1	WHAT'S THAT?	1	NO I HATE IT	1
THIS GIRL BUBBLE BATH	1	WHAT THAT?	3		
THIS GIRL BUBBLE	1	WHAT DO YOU DO?	1		
		WHAT YOU DO BOO-BOO?	1		

Aspect		Counterexamples			
THEN THEY WASH HAND DISHES	1	GOOD	3	THE SHOE AND SOCK	1
		AWFUL	1	THE BOY THE BUMP	1
S-embedding		A--	2	ONE TWO FOUR	1
		FOUR	2	I KNOW	1
I SAY GO SLEEP	1	CAUSE	2	MAKES IT ALL BETTER	1
		BECAUSE	1	TASTE GOOD	1
Conjunctive		NO	14	GO GO SCHOOL	1
Enumeration		YES	11	TAHT'S ALL	1
		YEAH	17	ALL OVER	1
FEET SHOES SOCK	1	OK	5	ALL BETTER	1
RING RING	1	OK?	8	WHAT ABOUT YOU?	1
CANDLE CANDLE CANDLE	1	TAPE?	1	HOW A YOU?	1
BOO-BOO BOO-BOO	1	ALRIGHT	1	STAY GIRL	1
BIRD BIRD	1	WHAT	1		

4.12 Language sample: Tyrome; 12 yr 1 m0 21 da
12 yr 1 mo 22 da

CATEGORIZATION OF ALL INTELLIGBLE UTTERANCES AND FREQUENCIES OF THEIR OCCURRENCES IN SAMPLES 14 JULY 1975 AND 15 JULY 1975.

4.13 Grammar: Tyrome; 12 yr 1 mo 21 da
12 yr 1 mo 22 da

Lexicon of Basic Expressions

Sentence	t	S	
Term	e	T	
Intransitive	t/e	IV	EAT , SLEEP , AWAY , UP , DRESSED , ...
Common Noun	t//e	CN	BICYCLE , NEST , BOO-BOO , HAND , ...
Agent	t///e	AG	MAN , BOY , GIRL , SQUIRREL , DUCK , ...
Auxiliary	(t/e)/(t/e)	AUX	GO , GET , WANNA , CAN'T , ...
Prototransitive	(t/e)/(t//e)	PTR	DO , ATE , FALL , RIDING , IN , ON , ...
CN Determiner	((t/e)/((t/e)/(t//e)))/(t//e)	DET	THE , A , HIS , HER , ONE , FOUR , ...
AG Demonstrative	(t/(t/e))/(t///e)	DEM	THIS , THE
Accusative	(t/e)/((t/e)/(t//e))	ACC	IT
Nominative*	t/(t/e)	NOM	I , YOU , HE , THEY , ...
S-Concord Negative	t/t	SCN	NO
Aspectual	t//t	ASP	THEN
WH-Question	t///t	WHQ	WHAT , WHAT DO , WHAT THAT , ...
S-Embedding IV	(t/e)/t	V/S	SAY , KNOW , ...

Syntax of Phrase Structure				Example
S1	t	→	t///e t/e	SQUIRREL EAT
S2	t	→	t///e t//e	BOY COAT
S3	t/e	→	(t/e)/(t//e) t//e	Ø ON SLED
S4	t/e	→	(t/e)/(t//e)	FALL
S5	t	→	t/e	ATE IT
S6	t	→	t//e	RAIN
S7	t	→	t///e	PEOPLE
S8	t	→	t///t	WHY?
S9	t	→	t/(t/e) t/e	HE EAT
S10	t/e	→	(t/e)/(t//e) (t/e)/((t/e)/(t//e))	BRUSH HER TEETH
S11	t/e	→	(t/e)/(t/e) t/e	GO SLEEP
S12	t/(t/e)	→	(t/(t/e))/(t///e) t///e	THIS GIRL
S13	(t/e)/((t/e)/(t//e))	→	((t/e)/((t/e)/(t//e)))/(t//e) t//e	A FEET
S14	t/e	→	(t/e)/(t/e)	I WANNA GO
S15	t/e	→	(t/e)/t t	I SAY GO SLEEP
S16	t	→	t/t t	NO I CAN'T
S17	t	→	t//t t	THEN THEY WASH...

S18	t	→	t///t t ?	WHAT DO YOU DO?
S19	t//e	→	t//e t//e	FEET SHOES SOCK
S20	t	→	t/(t/e) t//e	THIS GIRL BUBBLE
S21	t	→	t/(t/e)	THE PEOPLE
S22	t	→	(t/e)/((t/e)/(t//e))	TWO RING
S23	t/e	→	EAT , SLEEP , AWAY , UP , DRESSED , ...	
S24	t//e	→	BICYCLE , NEST , BOO-BOO , HAND , ...	
S25	t///e	→	MAN , BOY , GIRL , SQUIRREL , DUCK , ...	
S26	(t/e)/(t/e)	→	GO , GET , WANNA , CAN'T , ...	
S27	(t/e)/(t//e)	→	DO , ATE , FALL , RIDING , IN , ON , ...	
S28	((t/e)/(t/e)/(t//e)))/(t//e)	→	THE , A , HIS , HER , ONE , FOUR , ...	
S29	(t/(t/e))/(t///e)	→	THIS , THE	
S30	(t/e)/((t/e)/(t//e))	→	IT	
S31	t/(t/e)	→	I , YOU , HE , THEY , ...	
S32	t/t	→	NO	
S33	t//t	→	THEN	
S34	t///t	→	WHAT , WHAT DO , WHAT THAT , ...	
S35	(t/e)/t	→	SAY , KNOW , ...	

Semantics of Logical Translation	Example Symbolization
T1 $\forall \underline{u}\,[AG(\hat{}\underline{u}) \wedge IV(\hat{}\underline{u})]$	$\forall \underline{u}\,[\underset{\sim\sim\sim\sim\sim\sim\sim\sim}{\text{SQUIRREL}}'(\hat{}\underline{u}) \wedge \underset{\sim\sim\sim}{\text{EAT}}'(\hat{}\underline{u})]$
T2 $\forall r \forall \underline{u}\,[\underline{r}(\hat{}CN)(\hat{}\underline{u}) \wedge AG(\hat{}\underline{u})]$	$\forall \underline{r} \forall \underline{u}\,[\underline{r}(\hat{}\underset{\sim\sim\sim\sim}{\text{COAT}}')(\hat{}\underline{u}) \wedge \underset{\sim\sim\sim}{\text{BOY}}'(\hat{}\underline{u})]$
T3 $PTR(\hat{}CN)$	$\underset{\sim\sim}{\text{ON}}'(\hat{}\underset{\sim\sim\sim\sim}{\text{SLED}}')$
T4 $\lambda \underline{x} \forall \underline{z}\,[PTR(\hat{}\underline{z})(\underline{x})]$	$\lambda \underline{x} \forall \underline{z}\,[\underset{\sim\sim\sim\sim}{\text{FALL}}'(\hat{}\underline{z})(\underline{x})]$
T5 $\forall \underline{u}\,[IV(\hat{}\underline{u})]$	$\forall \underline{u} \forall \underline{z}_1\,[\underset{\sim\sim\sim}{\text{ATE}}'(\hat{}\underline{z}_1)(\hat{}\underline{u})]$
T6 $\forall \underline{u}\,[CN(\hat{}\underline{u})]$	$\forall \underline{u}\,[\underset{\sim\sim\sim\sim}{\text{RAIN}}'(\hat{}\underline{u})]$
T7 $\forall \underline{u}\,[AG(\hat{}\underline{u})]$	$\forall \underline{u}\,[\underset{\sim\sim\sim\sim\sim\sim}{\text{PEOPLE}}'(\hat{}\underline{u})]$
T8 $?\forall \underline{P}\,[WHQ(\underline{P})]$	$?\forall \underline{P}\,[\underset{\sim\sim\sim\sim\sim\sim\sim\sim}{\text{BECAUSE}}'(\underline{P})]$
T9 $NOM(\hat{}IV)$	$\forall \underline{u}_3\,[\underset{\sim\sim\sim}{\text{EAT}}'(\hat{}\underline{u}_3)]$
T10 $ACC(\hat{}PTR)$	$\forall \underline{u} \forall \underline{u}_4\,[\underset{\sim\sim\sim\sim\sim}{\text{BRUSH}}'(\hat{}\underset{\sim\sim\sim\sim\sim}{\text{TEETH}}')(\hat{}\underline{u}) \wedge \underline{u}_4 = \underline{u}]$
T11 $AUX(\hat{}IV)$	$\underset{\sim\sim}{\text{GO}}'(\hat{}\underset{\sim\sim\sim\sim\sim}{\text{SLEEP}}')$
T12 $DEM(\hat{}AG)$	$\lambda \hat{} \underline{z}_2 \forall \underline{u}\,[\underset{\sim\sim\sim\sim}{\text{GIRL}}'(\hat{}\underline{u}) \wedge \underline{z}_2(\hat{}\underline{u})]$
T13 $DET(\hat{}CN)$	$\lambda \underline{r} \lambda \underline{x} \forall \underline{z}_1\,[\underline{r}(\hat{}\underset{\sim\sim\sim\sim}{\text{FEET}}')(\underline{x}) \wedge \underline{z}_1 = \underset{\sim\sim\sim\sim}{\text{FEET}}']$
T14 $\lambda \underline{x} \forall \underline{z}\,[AUX(\hat{}\underline{z})(\underline{x})]$	$\forall \underline{u}_1 \forall \underline{z}\,[\underset{\sim\sim\sim\sim\sim}{\text{WANNA}}'(\hat{}\underset{\sim\sim}{\text{GO}}'(\hat{}\underline{z}))(\hat{}\underline{u}_1)]$
T15 $V/S(\hat{}S)$	$\forall \underline{u}_1\,[\underset{\sim\sim\sim}{\text{SAY}}'(\hat{}[\forall \underline{u}\,[\underset{\sim\sim}{\text{GO}}'(\hat{}\underset{\sim\sim\sim\sim\sim}{\text{SLEEP}}')(\hat{}\underline{u})]])(\hat{}\underline{u}_1)]$

T16 SCN [S"] ∧ S → $\neg\ \forall u_1 \forall z\ [\underset{\sim\sim\sim}{CAN}''(\hat{}z)(\hat{}u_1)] \wedge \forall u_1 \forall z \neg\ [\underset{\sim\sim\sim}{CAN}'(\hat{}z)(\hat{}u_1)]$

where S' is part of the presuppositional common ground and S" is obtained by converting variables in S' to agree with S.

T17 ASP [S] → $\underset{\sim}{W}\forall u_5\ [\underset{\sim\sim\sim\sim}{WASH}'(\lambda x\ [\underset{\sim\sim\sim\sim}{HAND}'(x) \wedge \underset{\sim\sim\sim\sim\sim\sim}{DISHES}'(x)])(\hat{}u_5)]$

T18 WHQ [S] → $?\forall r \forall u_2 \forall z \forall r\ [r(\hat{}z)(\hat{}u_2)]$

where any variables in WHQ are converted to agree with the highest-order variables in S.

T19 $\lambda x\ [CN(x) \wedge CN(x)]$ → $\forall u\ [\underset{\sim\sim\sim\sim}{FEET}'(\hat{}u) \wedge \underset{\sim\sim\sim\sim\sim}{SHOES}'(\hat{}u) \wedge \underset{\sim\sim\sim\sim}{SOCK}'(\hat{}u)]$

T20 NOM(^CN) → $\forall u\ [\underset{\sim\sim\sim\sim}{GIRL}'(\hat{}u) \wedge \underset{\sim\sim\sim\sim\sim\sim}{BUBBLE}'(\hat{}u)]$

T21 $\forall z\ [NOM(\hat{}z)]$ → $\forall z \forall u\ [\underset{\sim\sim\sim\sim\sim\sim\sim}{PEOPLE}'(\hat{}u) \wedge z(\hat{}u)]$

T22 $\forall r \forall u\ [ACC(r)(\hat{}u)]$ → $\forall r \forall u \forall 2z_1\ [r(\hat{}\underset{\sim\sim\sim\sim}{RING}')(\hat{}u) \wedge z_1 = \underset{\sim\sim\sim\sim}{RING}']$

T23 $\underset{\sim\sim\sim}{EAT}'$, $\underset{\sim\sim\sim\sim\sim}{SLEEP}'$, $\underset{\sim\sim\sim\sim}{AWAY}'$, $\underset{\sim\sim}{UP}'$, $\underset{\sim\sim\sim\sim\sim\sim\sim}{DRESSED}'$, ...

T24 $\underset{\sim\sim\sim\sim\sim\sim\sim}{BICYCLE}'$, $\underset{\sim\sim\sim\sim}{NEST}'$, $\underset{\sim\sim\sim\sim\sim\sim\sim}{BOO\text{-}BOO}'$, $\underset{\sim\sim\sim\sim}{HAND}'$, ...

T25 $\underset{\sim\sim\sim}{MAN}'$, $\underset{\sim\sim\sim}{BOY}'$, $\underset{\sim\sim\sim\sim}{GIRL}'$, $\underset{\sim\sim\sim\sim\sim\sim\sim\sim}{SQUIRREL}'$, $\underset{\sim\sim\sim\sim}{DUCK}'$, ...

T26 $\underset{\sim\sim}{GO}'$, $\underset{\sim\sim\sim}{GET}'$, $\underset{\sim\sim\sim\sim\sim}{WANNA}'$, $\lambda z \lambda x \neg\ [\underset{\sim\sim\sim}{CAN}'(\hat{}z)(x)]$, ...

T27 $\lambda z \lambda x \lambda r\ [r(\hat{}z)(x)]$, $\underset{\sim\sim\sim}{ATE}'$, $\underset{\sim\sim\sim\sim}{FALL}'$, $\underset{\sim\sim\sim\sim\sim\sim}{RIDING}'$, $\underset{\sim\sim}{IN}'$, $\underset{\sim\sim}{ON}'$, ...

T28 $\lambda\hat{}z \lambda r \lambda x \forall z_1\ [r(\hat{}z)(x) \wedge z_1 = z]$, $\lambda\hat{}z \lambda r \lambda x \forall z_1\ [r(\hat{}z)(x) \wedge z_1 = z]$,

$\lambda\hat{}z \lambda r \lambda x \forall u_3\ [r(\hat{}z)(x) \wedge u_3 = u]$, $\lambda\hat{}z \lambda r \lambda x \forall u_4\ [r(\hat{}z)(x) \wedge u_4 = u]$,

$\lambda\hat{}z \lambda r \lambda x \forall 2z_1\ [r(\hat{}z)(x) \wedge z_1 = z]$, $\lambda\hat{}z \lambda r \lambda x \forall 4z_1\ [r(\hat{}z)(x) \wedge z_1 = z]$, ...

T29 $\lambda\hat{}\underline{z}_1\lambda\hat{}\underline{z}_2\forall\underline{u}\,[\underline{z}_1(\hat{}\underline{u}) \wedge \underline{z}_2(\hat{}\underline{u})]$, $\lambda\hat{}\underline{z}_1\lambda\hat{}\underline{z}_2\forall\underline{u}\,[\underline{z}_1(\hat{}\underline{u}) \wedge \underline{z}_2(\hat{}\underline{u})]$

T30 $\lambda\hat{}\underline{r}\lambda\underline{x}\forall\underline{z}\,[\underline{r}(\hat{}\underline{z})(\underline{x})]$

T31 $\lambda\hat{}\underline{z}\forall\underline{u}_1\,[\underline{z}(\hat{}\underline{u}_1)]$, $\lambda\hat{}\underline{z}\forall\underline{u}_2\,[\underline{z}(\hat{}\underline{u}_2)]$, $\lambda\hat{}\underline{z}\forall\underline{u}_3\,[\underline{z}(\hat{}\underline{u}_3)]$, $\lambda\hat{}\underline{z}\forall\underline{u}_5\,[\underline{z}(\hat{}\underline{u}_5)]$, ...

T32 $\lambda\underline{P}\,\neg\,[\underline{P}]$

T33 $\lambda\underline{P}\;\underline{W}\;[\underline{P}]$

T34 $\lambda\underline{P}\;?\forall\underline{v}_n\,[\underline{P}]$, $\lambda\underline{P}?\forall\underline{r}_n\,[\underline{P}]$, $\lambda\underline{P}?\forall\underline{z}_n\,[\underline{P}]$, ...

where $\underline{v}_n$ is a variable of any type.

T35 SAY' , KNOW' , ... [5]

---

[5] The semantics of this grammar introduces two additional devices. The variable, $\underline{r}$, is over the category of prototransitives, being of type <<s,<<s,e>,t>>,<<s,e>,t>> . There is nothing remarkable in this-- it provides a treatment for DO as a proform and is very helpful in the second-order treatment of the case system. An addition is also needed for numerically exact quantification-- $\forall 2\underline{v}$ being a quantifier requiring exactly two members of the variable's type. This is not a very enlightened treatment for the plural as substantial alteration of the model structure is thought necessary for adequate treatment. Bennett (1974) provides a better consideration than here, although many features of adult plurality are notably missing in early child language and considerable empirical testing of semantical modeling with the intensional structure will be necessary before consensus will be reached.

Disorders are almost always underdetermined by clinical procedure, especially by first-referral synchronic methods. Disorders are among the most frustrating of the disabilities to adequately analyze because seemingly small performances produce very large grammars with inelegant rules and many counterexamples. This sample from Tyrome has all these investigative properties. Although the basic nature of the disorder is simple, the grammar is large and clumsy, having many points of data-thin speculation needing substantial empirical testing and follow-up that is unlikely in most clinical settings. Simple disorders are the result of well-formed rules of grammar interacting in a manner which is inconsistent or inefficient for communication. Simple disorders rarely fail in communication-- unlike complex disorders and deviations which often misinform or are uninterpretable. Like the language delay, disorders seem related in etiology to limitations of the performance capacities: there being inconsistent evidence for greater mental competence which the performance system cannot uniformly access and utilize. Precise differential diagnosis between delay and simple disorder is bound to be somewhat speculative until some adequate specification of the brain's performance capacities is available, but until then description of mental competence in a system of faulty performance may be of value on other grounds. Remedial interventions upon the organic structure of the brain may not be possible for some time yet, but prosthetic forms of intervention may be feasible in some cases where greater linguistic competence can be demonstrated.

The fundamental disorder in Tyrome's language sample involves a marked inconsistency in phrase structure between a first-order logic and

a second-order logic, this distinction hinges on the prototransitive predicates. In the logical interpretation of such a language, first-order treatment is the most direct combinatorial relationship between the semantical functions-- t/e , t//e , t/t , and the like-- all being categories with a first-order relationship to the primitives. In the 4.13 grammar, the syntactical rules, S1-S8 , are a portion of the grammar where the phrase structure combines in first-order relations; and the translation rules in the logic, T1-T8 , are required to supply the semantical interpretations in much the same manner as Shannon and Janice did. The category of agent, t///e , seems to be syntactically distinct from common nouns, but Tyrome does not provide any evidence that they should be semantically treated as primitive terms in category, e . An agent expression is a semantical function which selects sets of individuals rather than indicating a particular individual. This latter definite description must be supplied for first-order expressions with non-categorial rules or through the holophrase portion of the syntax, S5-S8 , in the manner of little children.

The second-order portion of Tyrome's grammar, S9-S13 , gives yet another phrasal method for constructing sentences. The nominative category, t/(t/e), requires an intransitive expression to produce a t-level sentence; while the accusative category, (t/e)/((t/e)/(t//e)) , has the second-order relationship to prototransitive expressions, requiring one to produce an intransitive expression. This second-order pathway to the truth values is a method which gives a consistent treatment for the productive use of proforms, agent demonstratives, and noun determiners which do not seem present in the simpler first-order system of early syntax.

These categories and the appearance of the auxiliary may be the acquisitional evidence needed for the reanalysis from the earliest first-order phrase structures into the subsequent stage of second-order treatment.

The use of the clinical term, disorder, in this case deserves some scrutiny. Clearly, there are enough minimal contrasts in this sample to establish inconsistent use of the demonstratives and determiners: GIRL COOK having the same interpretation as THIS GIRL COOK ; BOY RIDING SLED contrasts with an intermediate first/second-order expression BOY RIDING A BIKE and finally a complete second-order expression THIS BOY RIDING A BIKE . Contrasts like these suggest that a uniform semantical interpretation in the model should be assigned to these structures so that the small words appear optional. Previous grammatical analyses like Braine's or Bloom's without rigorous semantical treatments have been able to use autonomous syntactical optionality to simplify the form of syntactical rules, but there is no such thing as optionality in semantics. A meaning is either present or absent, and the syntactical option in phrase structure is a short-hand form of notation, collapsing similar rules. In the child language literature it has sometimes been claimed that obligatory forms are initially acquired as optional forms, but this amounts to the claim that these forms initially have no meaning.
The semantical component of this analytic method must rule out syntactic optionality as a formal device to account for the inconsistency in the demonstrative/determiner distribution in the sample. Assigning two ways of building sentential propositions may seem inelegantly redundant for the syntax, but it is necessary for compositional meanings. Having both a first-order and second-order treatment in the same grammar at least

suggests how acquisition may build upon the earlier phrase structure so that both forms occur in the logic at the same time. Reanalysis must proceed by adding second stage grammar before the earlier stage is no longer available.

Viewed in this manner, the use of the term disorder does not seem to suggest the sense of mental pathology in which the earlier child rules are inappropriately interacting with later adult forms. The etiology of a simple disorder may be the same as the language delay but with a point of acquisitional termination occurring between two stages of grammar organization. The apparent inconsistency of a disorder in language development may be a transitional phase between stages which has become elongated or fixed.

There are probably no simple clinical procedures which can adequately describe a childhood language disorder upon a single application of the technique. The diagnosis of disorder should be the result of an analysis which finds the usual kind of rules interacting to produce some inconsistent or unusual expressions. A syntactical disorder, such as suggested here for Tyrome, is not an easy matter to arrive at. For any set of data there are an indefinite number of syntactical components capable of generating the sample, and sorting through them becomes a big analytical problem. Under the usual circumstances, metalinguistic principles are used to constrain the analysis to the simplest grammars, the smallest number of primitives, and so forth. But even a simple disordering of the recursive devices goes against these principles and results in major inconsistency and diversity in a sample. One of the most difficult problems in the proper analysis for a disordered sample is to

find the grammar which does not have productivity within its set of counterexamples. In Tyrome's case, this requires that both first-order and second-order treatments of phrase structure be involved, resulting in major metalinguistic inelegance for the grammar construction. The clinician faced with such inconsistency in initial data should be prepared for collecting much larger samples and devising elicitation techniques to tease out the predictions and details of disordered rules which might rarely occur in spontaneous conversation and be wholly unexpected by standard psychometrics. It is not very easy to arrive at certainty in the analysis of disorders, because in many respects they converge or approximate the results of the usual grammars.

4.2 A written language sample from daily school exercises is given in this section to provide a wider empirical foundation for the descriptive method of language disability. All of the data before this have been of vocal speech since this is the most common form of communication, but this should not lead to the unfortunately common misunderstanding that vocalization is an essential and primary form in language and that the analysis of signed language or written expressions are somehow secondary to auditory symbols. The primacy of oral speech is a myth. Language is essentially a mental process and its perfromance by tongue, hand or machine can all be the object of study in the construction of a grammar. There are, of course, systematic differences found within each performance mode, but these are differences in style or task. Mental principles of grammar are what any mode of communication with a single language must share in order to succeed.

It is the case, however, that one performance mode has definite advantages for sampling. There are some handicapped people who are less able to communicate with speech so that the analysis of their grammatical ability may better proceed in other symbol systems. Many deaf persons find natural expression with manual signs, some cerebral palsied people communicate with machines designed to handicap their limited movements, and recently some children have been taught to place small plastic shapes in grammatical sequences. There is nothing essentially inferior about speech substitutes as the substrate for linguistic analysis because the subject of analytic concern is the mind which puts the order to the symbols.

The subject of this study is a fifteen year old boy, John, with a long history of severe behavior disorder. The son of an Air Force family, John was conceived in Japan where his father contracted a form of viral encephalitis. John was born in England one week before his father died of a recurrent attack of encephalitis on Christmas day. John had developed a serious ear infection presumably from a transatlantic flight in a nonpressurized aircraft when three weeks old, but the infection responded to standard antibiotic treatment. The boy developed normally until the age of two and a half when he unexplainably ceased talking and begun communicating through screams, grunting, and finger points. Since that time a rich history of medical and psychological treatments have failed to make alteration or insight into his condition. Psychiatrists diagnosed him as autistic and prescribed treatments to his mother; neurologists described him as brain damaged and prescribed tranquillizer; psychologists found John to be mentally retarded and trained him with

reinforcers; educators called him learning disabled and assigned him worksheets for eye-hand coordination. Through long and varied treatments, John remained noncommunicative-- prone to screaming and occasional violence. When aged six years, his family's supporting capacities failed and he entered a state institution for the mentally retarded where he rocked on a bench in a concrete room for six years. In this institution's school he drew very elaborate cuckoo clocks. A fortunate remarriage allowed John, ages 12, to return to his family and enter a community program for the handicapped. Medical diagnosis upon entry: Chronic Brain Syndrome, causation unknown with lack of neurological findings.

During the period of this study, calender 1973, John's ability to communicate remained simple: he would infrequently utter short sentences or phrases-- less than six or seven words long-- and these had a noticeable stereotyped, memorized quality and peculiar intonation. Although he could understand and act upon almost any concrete information spoken to him in a direct manner, John produced very little spontaneous conversation and he spent much time in strange nonexpressive movements, body rocking, and intricate hand positioning. When aggitated he would scream shatteringly and bite the palm of his hand; but, in general, he was very pleasant to be with, clean and well groomed, and inventive in his amusements.

Throughout his lengthy history of disturbed behavior and low level of communication, John developed near normal graphic and artistic abilities-- even to the point of talent. Reflecting this ability pattern, those psychometric tests of a nonverbal or visual motor nature (Lieter,

Bender-Gestalt, Frostig, Merrill-Palmer, Goodenough-Harris) usually produced standard IQ equivalents in the high 80's, while those tests of a more verbal content (WISC, Binet, Peabody Picture Vocabulary) would repeatably score in the low 30 range. John greatly enjoyed drawings of startling detail and precise execution. He was skilled in most school art media, but his themes were usually of a repetitious and stereotyped nature which conveyed little if any expressive content. For years he drew elaborate deer-head cuckoo clocks with Roman numerals and long pull chains-- sometimes twenty clocks a day. There was a period in which he drew the complete playing board of a television game known as Concentration, play the game by himself by erasing and redrawing each of the 64 playing squares to finally expose a meaningless rebus. He understood the movements in the game without understanding the purpose. John drew the back of drive-in movie screens for a while; then detailed floor plans of nonexistent houses; lollipops in cellophane wrappers. Once enrolled in the long-term community school in 1971, an individualized special education program began a daily exercise of writing words and drawing an explanatory picture.

During the 1971-72 school year it was determined that John's language abilities were limited to simple sentence patterns which he could productively use in reading and writing expressively, although his vocal communication for social purpose remained generally stereotyped and inexpressive. Each school day during the morning schedule he was given two worksheets, each scribed into six rectangular areas. Some of these areas contained teacher-drawn pictures of objects and persons to which John would write an explanatory description. Other worksheet areas had

a teacher-written sentence to which he drew a representative illustration. His writing was clear and unambiguous although his spelling of new or unfamiliar lexical items was sometimes alphabet soup. When John had completed both worksheets, the instructor would observe as John would read aloud all of his words on both pages and the instructor would mark all spelling errors in a standard manner. This read-back gives complete certainty for intended word order, and at no time would the teacher comment upon choice of worded description or alter his wording. John was being taught only spelling through direct correction while the instructional emphasis in preparing the teacher-drawings and the teacher-sentences was to follow the forms of John's own language which was not being expressed through spontaneous speech. He would write productive descriptions when he would not or could not speak in conversation. His writing samples represent his basic linguistic abilities better than any vocal sample would.

The worksheets were sent home on a daily basis with other papers. His parents were so pleased with the exercises as to save them to show relatives and to read them with John on occasion. For long-term instructional control on this program, the teacher would receive the worksheets back upon a bimonthly basis. The retrieval rate during 1973 was 88.8% and thus this sample represents a substantial part of his written output for this year. Appendix D contains the complete set of student and teacher sentences with John's original spelling retained-- although this text shall only concern word order and meaning. Since John produced both sentences and drawings which are related through meaning and structure, the procedural uncertainties of establishing meanings in pragmatical

contexts can be kept to a minimum as enough drawings shall be presented for the reader to establish the relations to intuitional satisfaction. This method of pictorial elicitation does not sample some areas of grammar such as the negative or pronominalization, but it does supply some rather interesting evidence of John's interpretation of sentential structure concerning terms and predicates.

4.20 Language sample fragment: John; 15 yrs old

All occurrences of selected verbs categorized by major predicate structures.

teacher drawn : JOHN HANDWRITING

2JAN

SIT

Intransitive

3JAN LADY SIT DOWN
15FEB WOMAN SIT DOWN
11APR WOMAN SIT DOWN

Locative

27MAR WOMAN SIT DOWN THE COUCH
30MAR WOMAN SIT DOWN THE SWING
26NOV WOMAN SIT DOWN THE BED

Compound Vert Phrase

26FEB ELEPHANT SIT DOWN BREAK THE COUCH

LAY

Intransitive

16FEB LADY LAY DOWN
2APR TEACHER LAY DOWN

Locative

14MAR WOMAN LAY DOWN THE COUCH
26APR TEACHER LAY DOWN THE WATER
1MAY JOHN LAY DOWN THE BED
10SEP JOHN LAY DOWN THE COUCH
5NOV SANDY LAY DOWN THE COUCH

Counterexample

24JAN * LADY LAY DOWN GO TO SLEEP

HAS

Transitive

29JAN MAN HAS A GUN
30JAN TARZAN HAS A GARBAGE CAN
15FEB LION HAS A TIGER
20FEB OLDMAN HAS A DOG
23FEB MONKEY HAS A TARZAN
26FEB TEACHER HAS A RADIO
2MAR BAT HAS A TEACHER
6MAR TARZAN HAS A WOMAN
19MAR LADY HAS A TWO SNAKE
27MAR MAN HAS A HORSE
9APR TARZAN HAS A GARBAGECAN
9APR WOMAN HAS A GUN
23APR ELEPHANT HAS A FLOWER
25APR WOMAN HAS A PAINT
26APR TEACHER HAS A CRAYON
27APR LADY HAS A BERTBALL/("/lebring/")
3MAY MAN HAS A SLIPPERS
9MAY OLDMAN HAS A DOG
17MAY TARZAN HAS A TREE
17MAY RABBIT HAS A FENCE
21MAY SAM HAS A PUMP
11SEP MONKEY HAS A SNAKE
14SEP MAN HAS A TOY
27SEP MAN HAS AN ICE TRAY
8OCT SAM HAS A PUMP
9OCT SUPERMAN HAS A BOX
24OCT MONKEY HAS A TRAIN
30OCT JOHN HAS A BALL
1NOV LADY HAS A TWO SNAKE
9NOV WOMAN HAS A TEACHER
19NOV TARZAN HAS A TREE
29NOV MAN HAS A TOY
3DEC TARZAN HAS A LADY
11DEC SUPERMAN HAS A DRAGON

teacher drawn : JOHN WRITTEN

30JAN TARZAN HAS A GARBAGE CAN

teacher drawn : JOHN WRITTEN

6MAR TARZAN HAS A TARZAN FALL DOWN

Compound Verb Phrase

4JAN TARZAN RUN HAS A MONKEY
9FEB TARZAN RIDE THE ELEPHANT HAS A FROG
6MAR TARZAN HAS A TARZAN FALL DOWN
7MAY TARZAN HAS A MAN FALL DOWN THE WATER
18SEP TARZAN RIDE THE LION HAS A KNIFE
13OCT JOHN GET OUT THE HOUSE HAS A GARBAGECAN
5NOV SAM GET OUT THE CAMPER HAS A GARBAGE CAN

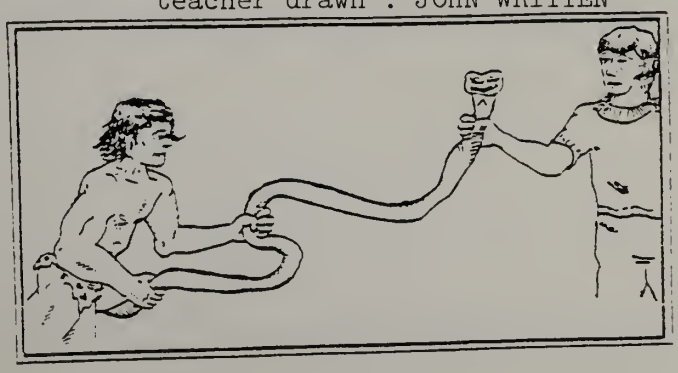
Conjoined Sentence

8JAN JOHN HAS A SNAKE AND TARZAN HAS A SNAKE
7MAY MONKEY ON THE TABLE AND JOHN HAS A FISH
16NOV JIM HAS A HORN AND TEACHER BLOW THE HORN

Counterexample

26FEB * SUPERMAN TWO HAS A DRAGON
11DEC * MAN HAS A PENNY AND TWO DIME

teacher drawn : JOHN WRITTEN



8JAN JOHN HAS A SNAKE AND TARZAN HAS A SNAKE →

Embedded Relative Clause

15JAN MONKEY HAS A TARZAN HAS A KNIFE
12FEB MOMMY HAS A ORANGE JUICE ON THE TABLE
7NOV MAN COME LADY HAS A WATCH

Conjoined Verb Phrase

2JAN WOMAN READ THE PAPER AND HAS A DOG
5MAR OLDMAN HAS A UMBRELLA AND HAS A HAT
13MAR JOHN HAS A FLOWER AND HAS A TWO WRENCH
16MAR TARZAN RIDE THE ELEPHANT AND HAS A KNIFE
30MAR TARZAN HAS A HOTDOG AND HAS A ICECREAM
14MAY WOMAN (PUT)(---) THE DRAGON AND HAS A KNIFE
26SEP MONKEY HAS A LADY AND HAS A TREE
8OCT TARZAN THROW THE HAMMER AND HAS A TREE

Compound Verb

6FEB TEACHER HAS A READ THE BOOK
2MAR CLOWN HAS A THROW THE CLOWN

Accusative-Locative

22JAN WOMAN HAS A GLASS THE JIM
13FEB TARZAN HAS A FISH THE WATER

teacher drawn : JOHN WRITTEN

15JAN MONKEY HAS A TARZAN HAS A KNIFE

teacher drawn : JOHN WRITTEN

22JAN WOMAN HAS A GLASS THE JIM

RUN
~~~

Intransitive

9MAR BATMAN RUN
19MAR WOMAN RUN
26MAR ELEPHANT AND CLOWN RUN
10APR POLICEMAN RUN
28SEP SAM RUN
3DEC MAN RUN

Locative

14FEB BATMAN RUN THE HAND
7MAR MAN RUN THE CHURCH
-APR INDIAN RUN THE WATER
30NOV WOMAN AND TEACHER RUN THE WATER

Compound Verb Phrase

4JAN TARZAN RUN HAS A MONKEY
11JAN SANDY RUN KICK THE HELICOPTER
18JAN BATMAN RUN KICK THE COW
22JAN INDIAN RUN JUMP OVER THE FENCE
13MAR LADY RUN KICK THE TELEPHONE
20MAR TARZAN RUN THE STEPS THROW THE FORK
26MAR JIM RUN KICK THE BICYCLE
9APR WOMAN RUN FALL THE WATER
30APR TARZAN RUN GO TO SCHOOL
1MAY SPACEMAN RUN GO TO ROCKET
20CT WOMAN RUN THROW THE BALL
28NOV TARZAN RUN GO TO SCHOOL
26MAR TARZAN RUN GO TO TRAIN

Conjoined Sentences

16FEB TARZAN RUN CLIMB UP THE STAIRS AND
LION RUN CLIMB UP THE STAIRS
26MAR WOMAN RUN AND
TEACHER RUN FALL OFF THE WATER

Counterexample

7MAR * MAN RUN OUT THE CHURCH
24MAR * WOMAN RUN TO STEPS
20SEP * TIGER RUN TO WATER
~~~

GO
~~

Locative

31JAN RABBIT AND PIG AND HORSE GO TO BOAT
31JAN SPIDER GO TO SCHOOL
1FEB BIRD GO TO BIRDHOUSE
7FEB TIGER GO TO BARN
20FEB SNAKE AND PIG AND COW AND LION GO TO BOAT
3APR CAR GO TO TRUCK
4MAY TWO SEAL GO TO BOAT
6SEP TWO ROCKET GO TO SUN
12SEP CAMPER GO TO DRIVE-IN
13SEP COW AND PIG AND HORSE GO TO BOAT
26SEP CAMPER GO TO CHURCH
5OCT TWO LION GO TO AIRPLANE
16OCT DRAGON GO TO STEPS
17OCT JOHN GO TO TREE
30OCT WOMAN GO TO SPIDER
27NOV TARZAN AND LADY GO TO HOUSE

Compound Vert Phrase

30APR TARZAN RUN GO TO SCHOOL
1MAY SPACEMAN RUN GO TO SCHOOL
6NOV LADY COME ON THE TARZAN GO TO HOUSE
28NOV TARZAN RUN GO TO SCHOOL

Conjoined Compound Verb

13NOV * TWO SNAKE GET OUT TEE AND GO TO THE DOGHOUSE
14NOV * TWO SNAKE GET OUT THE AND GO TO THE DOGHOUSE

Conjoined Sentences

31MAY TEACHER RIDE THE HORSE AND LADY GO TO HORSE

Counterexample

24JAN * LADY LAY DOWN GO TO SLEEP

ON
~~

Transitive

4JAN AIRPLANE ON THE BOX
1FEB BELL AND BOOK AND CANDLE ON THE TABLE
1MAR TARZAN ON THE ELEPHANT
22MAR DOG ON THE BALL
5APR TREE ON THE HOUSE
8MAY SPIDER ON THE LADY
17SEP LADY AND DEM ON THE COUCH
19SEP CAT ON THE CAR
2OCT BIRD HOUSE ON THE TREE
29OCT CAT ON THE CAMPER
12NOV TREE ON THE TRUCK
21NOV SNAKE ON THE BOX
30NOV LADY AND MAN ON THE COUCH
7DEC TREE ON THE TRUCK

Conjoined Sentences

21FEB CLOCK ON THE CHAIR AND HAT ON THE COUCH
7MAY MONKEY ON THE TABLE AND JOHN HAS A FISH
10DEC BALL LOOK UNDER THE TABLE AND BALL ON THE TABLE

GET OUT

GET OUT Locative

10JAN SNAKE GET OUT THE DOGHOUSE
16JAN MAN GET OUT THE CHURCH
23FEB WOMAN GET OUT THE CAR
14FEB SNAKE GET OUT THE CAMPER
13MAR TWO SNAKE GET OUT THE BIRDHOUSE
15MAR SANDY GET OUT THE CAR
23MAR ELEPHANT GET OUT THE TWO TRAIN
27MAR WOMAN GET OUT THE STORE
5APR WOMAN GET OUT THE ELEPHANT
26APR WOMAN GET OUT THE TRAIN
3MAY LADY GET OUT THE SPACE
14SEP SNAKE GET OUT THE BOX
25SEP SNAKE GET OUT THE STORE
10OCT CAT GET OUT THE TENT
1NOV WOMAN GET OUT THE STEPS
21NOV SNAKE GET OUT THE BIRDHOUSE
13DEC OLDMAN GET OUT THE CHURCH

Compound Verb Phrase

13OCT JOHN GET OUT THE HOUSE HAS A GARBAGECAN
5 NOV SAM GET OUT THE CAMPER HAS A GARBAGE CAN

Conjoined Compounded Verbs

13NOV * TWO SNAKE GET OUT THE AND GO TO THE DOGHOUSE
14NOV * TWO SNAKE GET OUT THE AND GO TO THE DOGHOUSE

Conjoined Sentences

2APR * MAN JUMPING AND MOUSE GET OUT THE TRUCK

GET

GET Transitive

6FEB WOMAN GET THE FISH
7FEB JOE GET THE BALL
8FEB DRAGON GET THE ELEPHANT
20FEB DRAGON GET THE SPACEMAN

Embedded Relative Clause

18SEP SPACEMAN GET A DOLLAR FROM THE BOX
24SEP SPACEMAN GET THE FILE FROM THE BOX
25SEP TEACHER GET THE WRENCH FROM THE TOOL BOX

Conjoined Verb Phrase

29NOV LADY RIDE THE HORSE AND GET THE BABY

PUT

TV-Parrticle Terminal

15JAN DAVID PUT THE BOOT ON
24JAN * BATMAN PUT THE BOOT ON AND BOOT
20FEB TEACHER PUT THE COAT ON
12SEP JOHN PUT THE TWO BOOT ON
2NOV MAN PUT THE TWO BOOT ON
13DEC BATMAN PUT THE WATCH ON

GIVE

Dative

12JAN LADY GIVE THE BALL TO JOHN
26FEB MAN GIVE THE KEY TO LADY
1-MAR LADY GIVE THE RADIO TO JIM
5APR BATMAN GIVES THE PIE TO MOMMY
12APR WOMAN GIVES THE DOLLAR TO JOHN
27APR JIM GIVES THE DOLLAR TO LADY
8MAY MAN GIVES THE DOLLAR TO INDIAN
19SEP TARZAN GIVES THE ICE CREAM TO TARZAN
25OCT LADY GIVES THE HORN TO JOHN
2NOV GIRL GIVES THE PUMPKIN TO SUPERMAN
12NOV JOHN GIVES THE DOLLAR TO BOX

Counterexample

16JAN * BATMAN GIVE THE TO BATMAN
16JAN * JOHN GIVES AND SOCK TO MAN
29JAN * TEACHER GIVES THE TO JOHN AND PAPER
9FEB * TEACHER GIVES THE TO LADY AND PAPER
16NOV * MAN GIVES THE DOLLAR AND FROM BOX

BREAK

Transitive

6NOV SAM BREAK THE CAMPER
15NOV DRAGON BREAK THE TREE

Stative

12FEB BREAK THE MOTOR CYCLE
18MAR BREAK THE MOTORCYCLE
11SEP BREAK THE AIRPLANE
6NOV BREAK THE ROCKET

Compound Verb Phrase

26FEB ELEPHANT SIT DOWN BREAK THE COUCH
1MAR TWO CLOWN THROW THE CAKE BREAK THE HAT

Compound Verb

27APR TWO MAN BREAK THE RIDE THE CAR

CUT

Instrumental

23JAN LADY CUT THE PIZZA AND KNIFE
30JAN MAN CUT THE CHAIN AND SAW
14FEB LADY CUT THE WATER MELON AND KNIFE
16FEB LADY CUT THE CORN AND KNIFE
21FEB LADY CUT THE CAKE AND KNIFE
21MAR LADY CUT THE CAKE AND KNIFE
22MAR SANDY CUT THE CAKE AND KNIFE
28MAR SANDY CUT THE BANANA AND KNIFE
25APR WOMAN CUT THE DRAGON AND KNIFE
10MAY MAN CUT THE BANANA AND KNIFE
15MAY MAN CUT THE CHEESE AND KNIFE
17SEP BATMAN CUT THE PUMPKIN AND KNIFE
10CT LADY CUT THE PIE AND KNIFE
26SEP LADY CUT THE BUTTER AND KNIFE
-0CT MICKEY THE MOUSE CUT THE PUMPKIN AND KNIFE
19OCT SAM CUT THE TREE AND HAMMER
23OCT TARZAN CUT THE LION AND KNIFE
2NOV LADY CUTS THE DRAGON AND KNIFE
15NOV BATMAN CUT THE PIZZA AND KNIFE
3DEC LADY CUT THE CHEESE AND KNIFE

Instrumentless Instrumental

-MAY LADY CUT THE PIZZA
30CT TEACHER CUT THE NUMBERS
19OCT LADY CUT THE FLOWER
16OCT MAN CUT THE FLOWER

4.21 Grammar: John; 15 yrs old

Lexicon of Basic Expressions

Sentence	t	S	
Term	e	T	JOHN , TEACHER , MOMMY , SAM , TARZAN , BATMAN , MAN , WOMAN , MONKEY , LION , BIRD , HORSE , TRAIN , AIRPLANE , BOOK , CUP , KNIFE , HAMMER , HAND , FINGER , PAINT , ...
Intransitive	t/e	IV	DIG , FALL , SLEEP , SIT , LAY , ...
Transitive Verb	t/ee	TV	HAS , TAKE
Locative Verb	t//ee	LV	GO , COME
Instrumental Vb	t/eee	MV	CUT
Dative Verb	t//eee	DV	GIVE
IV-Particle	(t/e)/(t/e)	IVPT	DOWN , OFF
TV-Particle	(t/e)/(t/ee)	TVPT	OUT , ON , UNDER , OVER , ...
T-Modifier	e/e	TMOD	TWO , THREE , PINK , RED , ...

ACC Case Marker :	$((t/e)/e)/(t/ee)$	: ACCMK :	THE
ACC Case Marker :	$((t/e)/e)/(t//ee)$	: ACCMK :	A
LOC Case Marker :	$((t/e)//e)/(t///ee)$	: LOCMK :	TO
LOC Case Marker :	$((t/e)//e)/(t/e)$	: LOCMK :	THE
INS Case Marker :	$((t/e)///e)/((t/e)////e)$	: INSMK :	AND
ACC Case Marker :	$(((t/e)////e)/e)/(t/eee)$	: ACCMK :	THE
DAT Case Marker :	$((t/e)///e)/((t/e)/////e)$	; DATMK :	TO
ACC Case Marker :	$(((t/e)/////e)/e)/(t//eee)$	: ACCMK :	THE
SS-Conjunct :	t/tt	: S&S :	AND
IV-Conjunct :	$(t/e)/(t/e)(t/e)$	: IV&IV :	AND
SUBJ-Conjunct :	$(t/e)/(t/e)(e)$	: &TIV :	AND [6]

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[6] To define a two-place function for the transitive relation, $(t/e)/e$, $(t/e)//e$, ... : If κ is of type $\langle\langle s,\langle s,e\rangle\rangle,\langle\langle s,e\rangle,t\rangle\rangle$ and both α and β are of type $\langle s,e\rangle$ then κ is a two-place relation and $\kappa(\beta,\alpha) = \kappa(\alpha)(\beta)$ which asserts that the objects denoted by the expressions α and β stand in the κ relation (similar to Montague 1974 : 259). A three-place function is also defined by recursion for the dative and intrumentals. The variable tr , is distinguished for two-place relations, and the variable, trr , for three-place functions. The variable, y , is like, x , being of type $\langle s,e\rangle$ and the subscripts on x-variables hold to their case to avoid variable collision, but the subscripts on variables of other types are loosely applied.

Syntax of Phrase Structure

		Rule Name	Example
S1	t → e t/e	Subject Predication	BATMAN DIG
S2	e → e/e e	Term Modification	TWO SNAKE
S3	t/e → (t/e)/e e	Predicate Object	HAS A GUN
S4	t/e → (t/e)//e e	Location	GO TO SUN
S5	t/e → (t/e)///e e	Instrument	CUT THE PIZZA AND KNIFE
S6	t/e → (t/e)////e e	Dative	GIVE THE BALL TO JOHN
S7	t/e → (t/e)/e (t/e)/((t/e)/e)	Relativization	HAS A TARZAN HAS A KNIFE
S8	t/e → t/e (t/e)/(t/e)	IV-Particle	SIT DOWN
S9	t/e → t/ee (t/e)/(t/ee)	TV-Particle	GET OUT
S10	t/e → (t/e)/e e (t/e)/(t/ee)	TV-Particle Terminal	PUT THE BOOT ON
S11	t/e → t/e t/e	IV-Compound	RUN HAS A MONKEY
S12	(t/e)/e → (t/e)/e (t/e)/e	Transitive Compound	BREAK THE RIDE THE
S13	(t/e)/e → t/ee ((t/e)/e)/(t/ee)	Accusative Marking	THROW THE
S14	(t/e)/e → t//ee ((t/e)/e)/(t//ee)	Accusative Marking	HAS A
S15	(t/e)///e → (t/e)////e ((t/e)///e)/((t/e)////e)	Instrumental Marking	CUT THE PIZZA AND
S16	(t/e)////e → (t/e)/////e ((t/e)////e)/((t/e)/////e)	Dative Marking	GIVE THE BALL TO
S17	(t/e)//e → t///ee ((t/e)//e)/(t///ee)	Locative Marking	GO TO

S18	(t/e)//e → t/e ((t/e)//e)/(t/e)	Locative Marking	RUN THE
S19	(t/e)////e → ((t/e)////e)/e e	Direct Object	CUT THE PIZZA
S20	(t/e)/////e → ((t/e)/////e)/e e	Direct Object	GIVE THE BALL
S21	((t/e)////e)/e → t/eee (((t/e)////e)/e)/(t/eee)	Accusative Marking	CUT THE
S22	((t/e)/////e → t//eee (((t/e)/////e)/e)/(t//eee)	Accusative Marking	GIVE THE
S23	t → t/e	Stative	BREAK THE MOTOR CYCLE
S24	t/e → (t/e)///e	Instrumentless:Instrumental	LADY CUT THE PIZZA
S25	(t/e)/((t/e)/e) → e t/e	Relative Clause Formation	TARZAN HAS A KNIFE
S26	t → t t/tt t	Sentence Conjunction	MONKEY ON THE TABLE AND JOHN HAS A FISH
S27	t/e → t/e (t/e)/(t/e)(t/e) t/e	IV-Conjunction	READ THE PAPER AND HAS A DOG
S28	t/e → (t/e)/(t/e)(e) e t/e	Subject Conjunction	AND HORSE GO TO BOAT
S29	e → JOHN , TEACHER , MOMMY , SAM , ...	Lexical Entry Rules	
S30	t/e → DIG , FALL , SLEEP , SIT , LAY , ...		
S31	t/ee → RIDE , GET , THROW , ON , ...		
S32	t//ee → HAS , TAKE		
S33	t///ee → GO , COME		
S34	t/eee → CUT		
S35	t//eee → GIVE		

S36 (t/e)/(t/e) → DOWN , OFF

S37 (t/e)/(t/ee) → OUT , ON , UNDER , OVER , ...

S38 e/e → TWO , THREE , PINK , RED , ...

S39 ((t/e)/e)/(t/ee) → THE

S40 ((t/e)/e)/(t//ee) → A

S41 ((t/e)//e)/(t///ee) → TO

S42 ((t/e)//e)/(t/e) → THE

S43 ((t/e)///e)/((t/e)////e) → AND

S44 (((t/e)////e)/e)/(t/eee) → THE

S45 ((t/e)///e)/((t/e)/////e) → TO

S46 (((t/e)/////e)/e)/(t//eee) → THE

S47 t/tt → AND

S48 (t/e)/(t/e)(t/e) → AND

S49 (t/e)/(t/e)(e) → AND

	Semantics of Logical Translation	Example
T1	IV(^T)	$\underset{\sim\sim\sim}{\text{DIG}}'(\hat{}\underset{\sim\sim\sim\sim\sim\sim}{\text{BATMAN}}')$
T2	TMOD(^T)	$\underset{\sim\sim\sim}{\text{TWO}}'(\hat{}\underset{\sim\sim\sim\sim\sim}{\text{SNAKE}}')$
T3	ACC(^T)	$\lambda\underline{x}_1\,[\underset{\sim\sim\sim}{\text{HAS}}'(\underline{x}_1,\hat{}\underset{\sim\sim\sim}{\text{GUN}}')]$
T4	LOC(^T)	$\lambda\underline{x}_1\,[\underset{\sim\sim}{\text{GO}}'(\underline{x}_1,\hat{}\underset{\sim\sim\sim}{\text{SUN}}')]$
T5	INST(^T)	$\lambda\underline{x}_1\,[\underset{\sim\sim\sim}{\text{CUT}}'(\underline{x}_1,\hat{}\underset{\sim\sim\sim\sim\sim}{\text{PIZZA}}',\hat{}\underset{\sim\sim\sim\sim\sim}{\text{KNIFE}}')]$
T6	DAT(^T)	$\lambda\underline{x}_1\,[\underset{\sim\sim\sim\sim}{\text{GIVE}}'(\underline{x}_1,\hat{}\underset{\sim\sim\sim\sim}{\text{BALL}}',\hat{}\underset{\sim\sim\sim\sim}{\text{JOHN}}')]$
T7	REL(^ACC)	$\lambda\underline{x}_1\,[\underset{\sim\sim\sim}{\text{HAS}}'(\underline{x}_1,\hat{}\underset{\sim\sim\sim\sim\sim\sim}{\text{TARZAN}}') \wedge \underset{\sim\sim\sim}{\text{HAS}}'(\hat{}\underset{\sim\sim\sim\sim\sim\sim}{\text{TARZAN}}',\hat{}\underset{\sim\sim\sim\sim\sim}{\text{KNIFE}}')]$
T8	IVPT(^IV)	$\lambda\underline{x}_1 \forall\underline{x}_3\,[\underset{\sim\sim\sim}{\text{SIT}}'(\underline{x}_1) \wedge \underset{\sim\sim\sim\sim}{\text{DOWN}}'(\underline{x}_1,\underline{x}_3)]$
T9	TVPT(^TV)	$\lambda\underline{x}_1 \forall\underline{x}_3\,[\underset{\sim\sim\sim}{\text{OUT}}'(\hat{}\underset{\sim\sim\sim}{\text{GET}}'(\underline{x}_1,\underline{x}_3))]$
T10	$\lambda\underline{x}_1 \forall\underline{tr}\,[\text{IV}(\underline{x}_1) \wedge \text{TVPT}(tr)(\underline{x}_1)]$	$\lambda\underline{x}_1 \forall\underline{tr}\,[\underset{\sim\sim\sim}{\text{PUT}}'(\underline{x}_1,\hat{}\underset{\sim\sim\sim\sim}{\text{BOOT}}') \wedge \forall\underline{x}_3\forall\underline{x}_2\,[\underline{tr}(\underline{x}_1,\underline{x}_2) \wedge \underset{\sim\sim}{\text{ON}}'(\underline{x}_2,\underline{x}_3)]]$
T11	$\lambda\underline{x}_1\,[\text{IV}(\underline{x}_1) \wedge \text{IV}(\underline{x}_1)]$	$\lambda\underline{x}_1\,[\underset{\sim\sim\sim}{\text{RUN}}'(\underline{x}_1) \wedge \underset{\sim\sim\sim}{\text{HAS}}'(\underline{x}_1,\hat{}\underset{\sim\sim\sim\sim\sim\sim}{\text{MONKEY}}')]$
T12	$\lambda\underline{x}_2\lambda\underline{x}_1\,[\text{ACC}(\underline{x}_1,\underline{x}_2) \wedge \text{ACC}(\underline{x}_1,\underline{x}_2)]$	$\lambda\underline{x}_2\lambda\underline{x}_1\,[\underset{\sim\sim\sim\sim\sim}{\text{BREAK}}'(\underline{x}_1,\underline{x}_2) \wedge \underset{\sim\sim\sim\sim}{\text{RIDE}}'(\underline{x}_1,\underline{x}_2)]$
T13	ACCMK(^TV)	$\lambda\underline{x}_2\lambda\underline{x}_1\,[\underset{\sim\sim\sim\sim\sim}{\text{THROW}}'(\underline{x}_1,\underline{x}_2)]$
T14	ACCMK(^TV)	$\lambda\underline{x}_2\lambda\underline{x}_1\,[\underset{\sim\sim\sim}{\text{HAS}}'(\underline{x}_1,\underline{x}_2)]$
T15	INSMK(^DOBJ)	$\lambda\underline{x}_4\lambda\underline{x}_1\,[\underset{\sim\sim\sim}{\text{CUT}}'(\underline{x}_1,\hat{}\underset{\sim\sim\sim\sim\sim}{\text{PIZZA}}',\underline{x}_4)]$
T16	DATMK(^DOBJ)	$\lambda\underline{x}_5\lambda\underline{x}_1\,[\underset{\sim\sim\sim\sim}{\text{GIVE}}'(\underline{x}_1,\hat{}\underset{\sim\sim\sim\sim}{\text{BALL}}',\underline{x}_5)]$
T17	LOCMK(^LV)	$\lambda\underline{x}_3\lambda\underline{x}_1\,[\underset{\sim\sim}{\text{GO}}'(\underline{x}_1,\underline{x}_3)]$

T18	LOCMK(^IV)	$\lambda x_3 \lambda x_1 \text{Vtr}\,[\underset{\sim}{\text{RUN}}'(x_1) \wedge \underline{\text{tr}}(x_1, x_3)]$
T19	TRR(^T)	$\lambda x_4 \lambda x_1\,[\underset{\sim}{\text{CUT}}'(x_1, \text{^}\underset{\sim}{\text{PIZZA}}', x_4)]$
T20	TRR(^T)	$\lambda x_5 \lambda x_1\,[\underset{\sim}{\text{GIVE}}'(x_1, \text{^}\underset{\sim}{\text{BALL}}', x_5)]$
T21	ACCMK(^MV)	$\lambda x_2 \lambda x_4 \lambda x_1\,[\underset{\sim}{\text{CUT}}'(x_1, x_2, x_4)]$
T22	ACCMK(^DV)	$\lambda x_2 \lambda x_5 \lambda x_1\,[\underset{\sim}{\text{GIVE}}'(x_1, x_2, x_5)]$
T23	$\text{V}x_1\,[\text{IV}(x_1)]$	$\text{V}x_1\,[\underset{\sim}{\text{BREAK}}'(x_1, \text{^}\underset{\sim}{\text{MOTOR-CYCLE}}')]$
T24	$\lambda x_1 \text{V}x_4\,[\text{INST}(x_4)(x_1)]$	$\text{V}x_4\,[\underset{\sim}{\text{CUT}}'(\text{^}\underset{\sim}{\text{LADY}}', \text{^}\underset{\sim}{\text{PIZZA}}', x_4)]$
T25	$\lambda \underline{r} \lambda x_1\,[\underline{r}(\text{^T})(x_1) \wedge \text{IV}(\text{^T})]$	$\lambda \underline{r} \lambda x_1\,[\underline{r}(\text{^}\underset{\sim}{\text{TARZAN}}')(x_1) \wedge \underset{\sim}{\text{HAS}}'(\text{^}\underset{\sim}{\text{TARZAN}}', \text{^}\underset{\sim}{\text{KNIFE}}')]$
T26	$\text{S\&S}(\text{S}_1)(\text{S}_2)$	$[\underset{\sim}{\text{ON}}'(\text{^}\underset{\sim}{\text{MONKEY}}', \text{^}\underset{\sim}{\text{TABLE}}') \wedge \underset{\sim}{\text{HAS}}'(\text{^}\underset{\sim}{\text{JOHN}}', \text{^}\underset{\sim}{\text{FISH}}')]$
T27	$\text{IV\&IV}(\text{IV}_1)(\text{IV}_2)$	$\lambda x_1\,[\underset{\sim}{\text{READ}}'(x_1, \text{^}\underset{\sim}{\text{PAPER}}') \wedge \underset{\sim}{\text{HAS}}'(x_1, \text{^}\underset{\sim}{\text{DOG}}')]$
T28	&TIV(^T)(IV)	$\lambda \underline{y}\,[\underset{\sim}{\text{GO}}'(\text{^}\underset{\sim}{\text{HORSE}}', \text{^}\underset{\sim}{\text{BOAT}}') \wedge \underset{\sim}{\text{GO}}'(\underline{y}, \text{^}\underset{\sim}{\text{BOAT}}')]$
T29	$\underset{\sim}{\text{JOHN}}'$, $\underset{\sim}{\text{TEACHER}}'$, $\underset{\sim}{\text{MOMMY}}'$, ...	
T30	$\underset{\sim}{\text{DIG}}'$, $\underset{\sim}{\text{FALL}}'$, $\underset{\sim}{\text{SLEEP}}'$, $\underset{\sim}{\text{SIT}}'$, $\underset{\sim}{\text{LAY}}'$, ...	
T31	$\underset{\sim}{\text{RIDE}}'$, $\underset{\sim}{\text{GET}}'$, $\underset{\sim}{\text{THROW}}'$, $\underset{\sim}{\text{ON}}'$, ...	
T32	$\underset{\sim}{\text{HAS}}'$, $\underset{\sim}{\text{THROW}}'$	
T33	$\underset{\sim}{\text{GO}}'$, $\underset{\sim}{\text{COME}}'$	
T34	$\underset{\sim}{\text{CUT}}'$	
T35	$\underset{\sim}{\text{GIVE}}'$	

T36 $\lambda \underline{z} \lambda \underline{x}_1 \forall \underline{x}_3 \, [\underline{z}(\underline{x}_1) \wedge \underset{\sim\sim\sim\sim}{\text{DOWN}}'(\underline{x}_1, \underline{x}_3)]$,

$\lambda \underline{z} \lambda \underline{x}_1 \forall \underline{x}_3 \, [\underline{z}(\underline{x}_1) \wedge \underset{\sim\sim\sim}{\text{OFF}}'(\underline{x}_1, \underline{x}_3)]$

T37 $\lambda \underline{\underline{tr}} \lambda \underline{x}_1 \forall \underline{x}_3 \, [\underset{\sim\sim\sim}{\text{OUT}}'(\hat{}\underline{\underline{tr}}(\underline{x}_1, \underline{x}_3))]$,

$\lambda \underline{\underline{tr}} \lambda \underline{x}_1 \forall \underline{x}_3 \forall \underline{x}_2 \, [\underline{\underline{tr}}(\underline{x}_1, \underline{x}_2) \wedge \underset{\sim\sim}{\text{ON}}'(\underline{x}_2, \underline{x}_3)]$,

$\lambda \underline{\underline{tr}} \lambda \underline{x}_1 \forall \underline{x}_3 \, [\underset{\sim\sim\sim\sim\sim}{\text{UNDER}}'(\hat{}\underline{\underline{tr}}(\underline{x}_1, \underline{x}_3))]$,

$\lambda \underline{\underline{tr}} \lambda \underline{x}_1 \forall \underline{x}_3 \, [\underline{\underline{tr}}(\underline{x}_1, \underline{x}_3) \wedge \underset{\sim\sim\sim\sim}{\text{OVER}}'(\underline{x}_1, \underline{x}_3)]$

T38 $\underset{\sim\sim\sim}{\text{TWO}}'$, $\underset{\sim\sim\sim\sim\sim}{\text{THREE}}'$, $\underset{\sim\sim\sim\sim}{\text{PINK}}'$, $\underset{\sim\sim\sim}{\text{RED}}'$, ...

T39 $\lambda \underline{\underline{tr}} \lambda \underline{x}_2 \lambda \underline{x}_1 \, [\underline{\underline{tr}}(\underline{x}_1, \underline{x}_2)]$

T40 $\lambda \underline{\underline{tr}} \lambda \underline{x}_2 \lambda \underline{x}_1 \, [\underline{\underline{tr}}(\underline{x}_1, \underline{x}_2)]$

T41 $\lambda \underline{\underline{tr}} \lambda \underline{x}_3 \lambda \underline{x}_1 \, [\underline{\underline{tr}}(\underline{x}_1, \underline{x}_3)]$

T42 $\lambda \underline{z} \lambda \underline{x}_3 \lambda \underline{x}_1 \, \underline{\underline{tr}} \, [\underline{z}(\underline{x}_1) \wedge \underline{\underline{tr}}(\underline{x}_1, \underline{x}_3)]$

T43 $\lambda \underline{r} \lambda \underline{x}_4 \lambda \underline{x}_1 \, [\underline{r}(\underline{x}_4)(\underline{x}_1)]$

T44 $\lambda \underline{\underline{\underline{trr}}} \lambda \underline{x}_2 \lambda \underline{x}_4 \lambda \underline{x}_1 \, [\underline{\underline{\underline{trr}}}(\underline{x}_1, \underline{x}_2, \underline{x}_4)]$

T45 $\lambda \underline{r} \lambda \underline{x}_5 \lambda \underline{x}_1 \, [\underline{r}(\underline{x}_5)(\underline{x}_1)]$

T46 $\lambda \underline{\underline{\underline{trr}}} \lambda \underline{x}_2 \lambda \underline{x}_5 \lambda \underline{x}_1 \, [\underline{\underline{\underline{trr}}}(\underline{x}_1, \underline{x}_2, \underline{x}_5)]$

T47 $\lambda \underline{P}_1 \lambda \underline{P}_2 \, [\underline{P}_1 \wedge \underline{P}_2]$

T48 $\lambda \underline{z}_1 \lambda \underline{z}_2 \lambda \underline{x}_1 \, [\underline{z}_1(\underline{x}_1) \wedge \underline{z}_2(\underline{x}_1)]$

T49 $\lambda \underline{x} \lambda \underline{z} \lambda \underline{y} \, [\underline{z}(\underline{x}) \wedge \underline{z}(\underline{y})]$

Before the main discussion of predicate structure in this sample, a few comments may be in order about the relationship between words and general cognitive concepts-- the graphic samples of these data provide a nice window into lexical semantics. The identification of word value can be made nonambiguous since John read each word aloud so the teacher could correct its spelling, thereby permanently identifying his intended sequence of words even though the spelling of some items seems to be random letter sequences. John did recognize that each word was properly spelled in one and only one manner as he did not alter spelling once mastery was achieved, and before mastery he would consistently reenter the same approximations. This permanence of spelling approximations may be observed in:

7MAR SNAIL AND /SEML/(NAIL) AND SNAIL AND /SEML/(NAIL)

and other examples from the sample where nonstandard spelling is preserved in differing contexts. Word boundaries are also nonambiguous since he wrote with cursive script. It is noticeable that some words like MOTOR CYCLE and MOTORCYCLE or GARBAGE CAN and GARBAGECAN receive somewhat different entries although it seems safe to treat them as single lexical items though a boundary is occasionally given. OLDMAN was always entered as a single word much like SUPERMAN and BATMAN and WOMAN . Both BAT and MAN are known to be separate words.

John's interpretations of graphic information into syntactical arrangements is remarkably consistent. In fact, it is possible to offer the following feature system as a guide to exploring the details of his drawings.

MAN : human; short hair

WOMAN : human; long light hair

LADY : human; long dark hair

MOMMY : LADY; flipped hairstyle; housecoat; slippers

SANDY : WOMAN; straight even hairstyle

JOHN : MAN; scalloped hairstyle

TEACHER : MAN; tie

TARZAN : MAN; long dark hair; loin cloth; muscles

BATMAN : MAN; pointed-ear cowl; fluted cape

SUPERMAN : MAN, S on chest; even cape

SPACEMAN : MAN; helmet; gloves

INDIAN : MAN; long dark hair; feather headdress

SAM : MAN; receeding hairline

JIM : MAN; short dark hair

This kind of graphical feature system can be interpreted either from John's statements about teacher drawings, or from these minimal features in his own pictures. It is tempting to consider these features as being the graphical equivalents of semantical individual concepts of type <s,e> which are the basis for term expressions in 4.21. Such a feature system is not of much importance in a sentential grammar as there are no apparent grammatical distinctions in either syntax or semantics which are contingent upon such subcategorization. It may seem surprizing that John interprets the distinction between a woman and a lady to be the color of their hair, and that his mother is a lady but not a woman but these distinctions are testable from the present data only in the

graphic array and not in the sentential. The metalinguistic features of Montague grammar stipulate that most lexical entry rules bring logical constants into the translation for most of the content words, and this is a very natural fit for John's grammar as sublexical information like that given above do not effect the derivations of sentences.

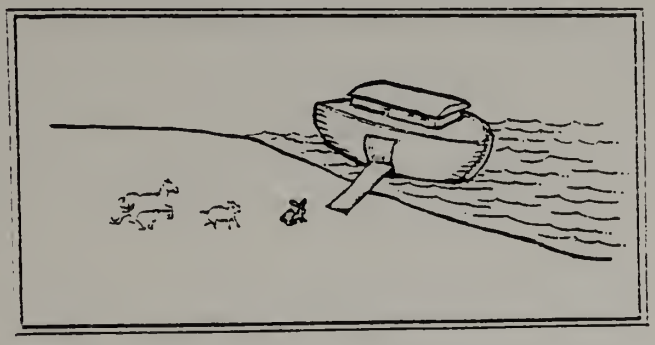
The predicate verbs can be given a similar system of graphical features:

HAS	:	x_1 touch x_2
RUN	:	bent leg
THROW	:	movement lines from x_2
GO TO	:	x_1 facing x_3; path
GET OUT	:	x_1 facing away x_3; path
GET	:	x_1 reach toward x_2
GRAB	:	x_1 reach toward x_2
KICK	:	x_1 bent leg x_2
GIVE	:	x_1 HAS x_2; x_1 reach toward x_5
TAKE	:	x_1 in bathtub or x_1 dressing with x_2-garment
PUT	:	x_1 dressing with x_2-garment
COME	:	x_1 or x_2 reach toward x_2 or x_1 respectively

These graphical features do serve to predict the string of words John would select to describe a drawing, but the features do not tend to put these verbs into subcategories for grammatical operations. For instance, GO TO and GET OUT are antonyms while GET and GRAB are synonyms by their graphical features yet there is no evidence of purely grammatical source which would distinguish these relationships. Both TAKE and

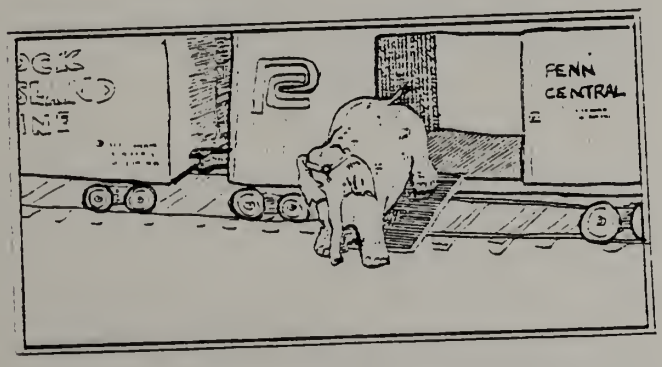
PUT are grammatically distinguished as part of a subset of verbs which permit IV-Particle termination in their sentences involving garments, but the particle-movement subset also includes TURN ... ON involving appliances. There may be some point in analyzing submorphological concepts in this manner for developing lexical semantics, but for the grammar of sentences there are little data to indicate that these graphical relationships affect the grammatical operations or categorical distinctions. It may be an interesting fact that grammatically equivalent conjuncts-- say, subjects-- are uniformly ordered from graphic right-to-left, but not much of the grammar hinges on such an odd fact.

teacher drawn : JOHN WRITTEN



31JAN RABBIT AND PIG AND HORSE GO TO BOAT

teacher drawn : JOHN WRITTEN



23MAR ELEPHANT GET OUT THE TWO TRAIN

teacher drawn : JOHN WRITTEN

30APR DRAGON GET THE SPACEMAN RUN

teacher drawn : JOHN WRITTEN

15OCT DRAGON GRAB THE SPACEMAN

It seems best to proceed with the discussion of the grammatical analysis upon the usual basis of translating words as unanalyzed constants of the logic rather than introducing formal methods for decomposing into tangible feature systems. Although this information is here in John's work, it is doubtful that such distinctions would make any big difference in his syntax or semantics as presented in 4.21.

The term expressions in the 4.21 grammar are given as a somewhat large collection of lexical items which do not have much phrase structural involvement in the rest of the syntax. An infrequent modifier-- eg. RED , TWO -- will attach to a term but by and large there is little

evidence to suggest that there is much activity in the grammar around this assortment of lexical items. Indeed, it is the fundamental claim of the 4.21 grammar that the terms do little else than fill in the positions of the case system that is based and marked upon the predicate verbs. This is to assign a very different grammatical role to the article-like words, THE and A , than the usual English grammar and to suggest that John's language is a complex disordered system with respect to English-- perhaps an example of deviation in language development.

The principle facts in establishing the predicate structure of 4.21 seem to center around the role of these small words and their relationship to the larger content words. By separating all instances of a particular verb, as in 4.20, it may be known that each verb (with few exceptions) is followed by a uniform sequence of small words with the term expressions alternating at fixed positions between them. Indeed, having separated all the sentences of the sample in this manner, it can be shown that the major distribution of the word A strongly coincides with the distribution of the words HAS , TAKE and BATH . Since the expression TAKE A BATH is a fixed sequence (other than two instances of 6FEB and 12FEB ...TAKE THE SHIRT ON), the primary productive distribution of the expression A is that it immediately follows HAS which is the most frequent verb in the language corpus.

Most of the other verbs in the sample are immediately followed by THE with some having particles intervening, but even these particles are strictly controlled by choice of verb. Thus, the five most frequent verbs in the sample are: HAS A in all 71 entries; RIDE THE in all 51

entries; GO TO in all 28 entries, RUN as a bare intransitive expression or followed by other verb phrases in 25 of 33 entries; GET OUT THE in the 'away-from' meaning or GET THE in the 'acquire' meaning in 33 of 34 entries. This kind of distribution continues through most all of the 52 verbs of the corpus. The small words are strongly related to the distribution of the verb rather than the noun-like terms. The 4.21 lexicon is organized by its verbs, the number of arguments they take, and the kinds of small words which follow them. This is the basis of the case system which distinguishes accusative, instrumental, dative, and locative by marking the verbs rather than the nouns.

The role of case systems in languages is to distinguish the semantical roles played by the major content words in a sentence. English distinguishes the semantical roles of its nouns by strictly controlling word order in relation to the verb. The first one in front of the verb is usually the subject unless other small words are about to indicate a different role. Other languages do not control word order so closely and they usually mark the nouns with small words or inflections to indicate their role in the interpretation of the sentence. English is historically a descendent of case inflected languages, and its pronoun system remains marked for the nominative, genitive, accusative. John's language is not only rather fixed in word order, but he appears to be marking verbs.

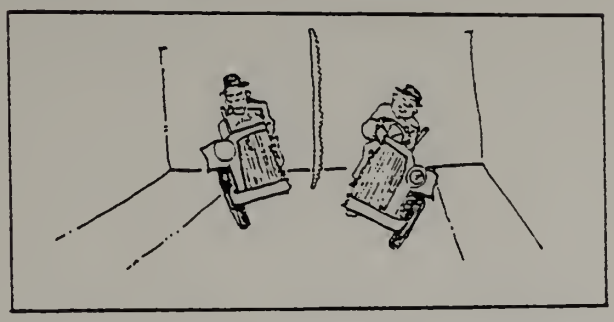
The compound accusative verb is the principle syntactical evidence that the small word belong to the verb. The TWO SNAKE counterexample is included with them because its redundant locative THE is also

missing an internal object whose interpretation depends upon information in a different part of the syntactical structure.

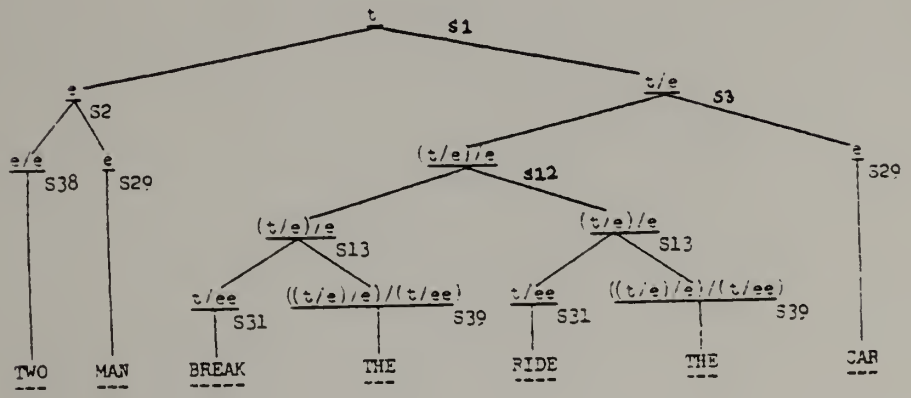
```
 6FEB    TEACHER HAS A READ THE BOOK
 2MAR    CLOWN HAS A THROW THE CLOWN
27APR    TWO MAN BREAK THE RIDE THE CAR

13NOV  * TWO SNAKE GET OUT THE AND GO TO THE DOGHOUSE
14NOV  * TWO SNAKE GET OUT THE AND GO TO THE DOGHOUSE
```

4.22 A compound accusative construction

teacher drawn : JOHN WRITTEN



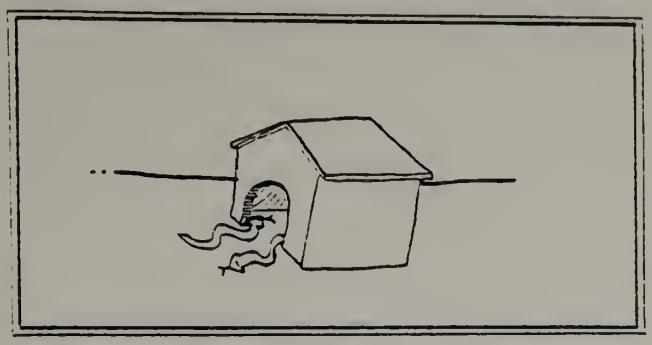
27APR TWO MAN BREAK THE RIDE THE CAR



BREAK'(^TWO'(^MAN'),^CAR') ∧ RIDE'(^TWO'(^MAN'),^CAR')

Even with this structure, there is a continued problem in the treatment of the plural subject. The two men seen in the car appear to be equally involved in the breaking and the riding of it. The two snakes are a different situation in which one is getting out of the doghouse while the other is getting in. The dual subject cannot be assigned individually to the compound predicates with any ease.

teacher drawn : JOHN WRITTEN



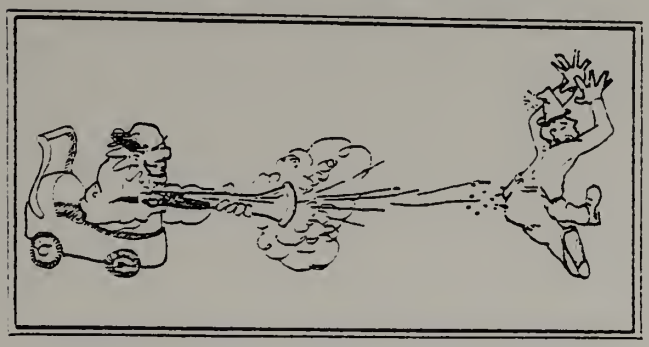
13NOV * TWO SNAKE GET OUT THE AND GO TO THE DOGHOUSE

If the two men form a collective-level subject in breaking and riding the car, the two snakes form a different kind of semantical collective for an antonym compound of getting in and getting out of the doghouse. The counterexample of 26FEB * SUPERMAN TWO HAS A DRAGON shows the man of steel holding a dragon in each hand. One can understand perfectly well John's intended interpretation but there is no comfortable feel about the grammar involved. Certainly English does not permit a simple adjectival modification of the verb phrase, but a more abstract level of phrase structure would predict such forms.

teacher drawn : JOHN WRITTEN

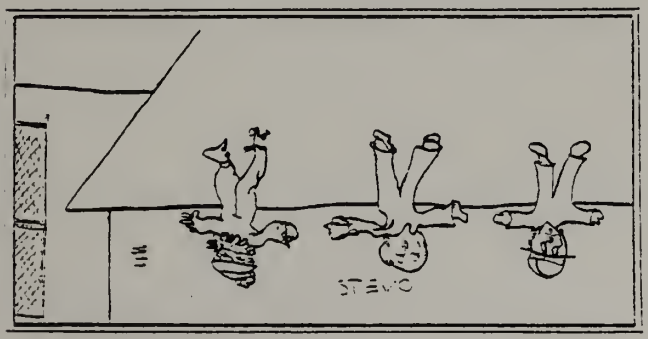
26FEB * SUPERMAN TWO HAS A DRAGON

teacher drawn : JOHN WRITTEN



23MAR TWO CLOWN SHOOT THE HORN

JOHN DRAWN : teacher written



15MAR Three clowns fall down

These examples suggest that there is some instability in John's interpretation of the plural although its subject-positioned syntax is

unremarkable (with the exception of the Superman example). The problem of an unstable relationship between syntax and semantics can be detailed in the distribution of the predicate, COME .

There are a few verbs in John's language which seem unstable in that their functional relation between the individuals would shift within different syntactical structures. These suggest that John may have been troubled in his analysis of English as a verb-marking case language with fixed word order. The counterexamples from the dative GIVE indicate that he has some uncertainty with the indirect object in syntax. He would probably encounter many examples in the language of others that would make it difficult to decide on the sequence of determiners which follow a newly developed verb. His verb COME is the most unstable lexical item in the sample-- its chronological sequence makes it a problem to decide how the semantics and syntax are coupled. There are many contrasts to suggest that the one-to-one correspondence is not yet established for this predicate.

The functional relationship for COME in John's graphics selects an individual proceeding toward another individual who has an outstretched hand. The hand is an essential feature of the function-- coming to some location involves someone's manual extention from that place. It should be clear from the following sample fragment that the hand-person is sometimes in subject position of COME and sometimes in the postverb case structure, rendering the verb unstable for interpretation.

4.23 A semantically unstable predicate: COME

Subject Hand-Attribute

10MAY MAN COME HERE THE LADY OPEN THE DOOR
25OCT MAN COME TO THE WOMAN
6NOV LADY COME ON THE TARZAN GO TO HOUSE
7NOV MAN COME LADY HAS A WATCH
12DEC MAN AND OLDMAN COME WITH ME GET OUT THE CHURCH
13DEC MAN COME WITH ME LADY
13DEC MAN COME WITH ME

teacher drawn : JOHN WRITTEN

6NOV LADY COME ON THE TARZAN GO TO HOUSE

teacher drawn : JOHN WRITTEN

7NOV MAN COME LADY HAS A WATCH

teacher drawn : JOHN WRITTEN

12DEC MAN AND OLDMAN COME WITH ME
GET OUT THE CHURCH

Object Hand-Attribute

12MAR WOMAN COME HERE THE MAN
23MAR SANDY COME WITH ME THE MAN
28MAR CAT COME HERE THE LADY
11SEP BABY COME TO HORSE THE SANDY

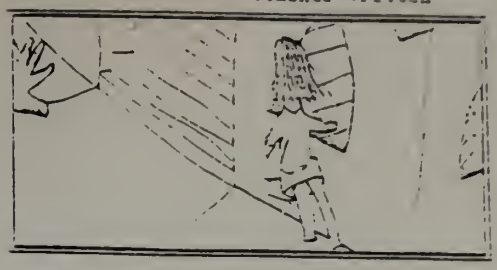
teacher drawn : JOHN WRITTEN

12MAR WOMAN COME HERE THE MAN

Teacher drawn : JOHN WRITTEN

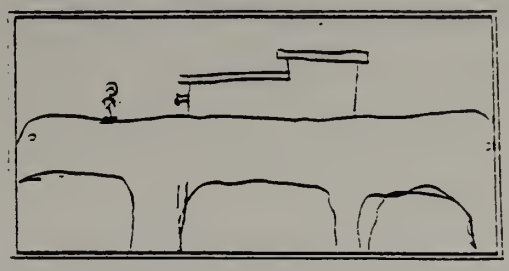
23MAR SANDY COME WITH ME THE MAN

JOHN DRAWN : Teacher written



16MAR Lady comes out of the church

JOHN DRAWN : Teacher written



5SEP John comes to school on the school bus

John's language has a number of odd structures in it, but many of them are systematic with the analysis of a case system as in 4.21, suggesting that the basic form of his disability is based in mental competence-- his knowledge of the rules of grammar are structured to generate the novel structures. Most case-marking languages mark the nouns rather than the verbs, but the descriptive metalanguage has no problem arriving at formal interpretations for such structures. Such an analysis is possible at least as a hypothetical language even if no actual natural language had ever developed such a system. Some of the problems in John's communication might stem from learning a wrong hypothesis about the nature of English which he is somehow unable to disconfirm. The complexity of a disorder like 4.21 relative to standard English interprets surface structure in a very different manner from the rest

of the linguistic community although there is a marked degree of convergence for simple sentences. Children with language deviations (if this be one) have been observed to develop an apparently normal early stage of acquisition and then to remain stationary for a long time. It may be that some possible hypotheses about language form a cul-de-sac or an acquisitional dead-end where subsequent development might require something quite uninterpretable by these wrong-way hypotheses. A complex disorder which approximates the early stages of development could account for these observations. This leaves open the issue of language deviation as being a breakdown in the actual rules of the language where a formal treatment would presumably require some violation of metalanguage. Such a language may be thought of in the class of impossible languages so a person with such a language would be disabled to the degree deviant.

5.0 Conclusions

Theoretical work is highly valued in science because it is rare and difficult to weave the threads of data into new fabric-- the old cloth seems to cover so much and the new patterns seem forbiddingly complex when first encountered. Child language as an academic study has been collecting data for structural theories since it's beginnings in the early part of this century. Generative theories of syntax made an early entry through the work of Lois Bloom, but has remained rather stationary since then, lapsing back into structuralism.

Much of the labor in this study has been the struggle to sort out the thin strands of semantical interpretation and introduce a formal treatment for compositional meaning which can hold it own beside the best generative syntax. Many of the fine details in the grammars have been selected to exercise the theory at points where the empirical data is rarefied and uncertain, producing prediction rather than verification. The history of empirically-testable knowledge shows that paradigm revolutions occur frequently from prediction and the control of previous theory counterexamples. Formal semantics have been developing for a long time within philosophical circles, and it is hoped that the time is here for an empirical connection into psychology and application in education. The description of child language and how it changes with learning should have direct consequences for the understanding of language disability, and our efforts to understand mental incompetence helps to complete the formal specification of human abilities. There will be a time when these grammars-- now so complicated-- will be child's play.

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TRANSCRIPT, Observational
Chronological: [illegible]
[illegible]

Shannon
27 Oct 76 -1

[illegible] Belinda, neighbor girl age 5 yrs., is preparing to leave and Shannon is following her.

[illegible] BELINDA (pronounced /BE'LIN.DA/)
BELINDA
BELINDA
BELINDA
BELINDA
[illegible]
BELINDA (Belinda leaves)

BAES
BAES /BAES/

[illegible] BELINDA
BELINDA

[illegible] UP (following mother, wanting up)
UP
/ UP

BIKE (Getting the bike to sit on)
BIKE
BIKE
BIKE
BIKE

[illegible] DADDY'S SHOE (In bedroom, getting father's sneakers
DADDY'S SHOE one at a time and pairing them on
DADDY'S SHOES the other side of the room)
DADDY'S SHOES
DADDY'S SHOES
DADDY'S SHOES
DADDY'S SHOE
DADDY'S
DADDY'S

MOMMY'S SHOE
DADDY'S SHOES
MOMMY'S (Placing one of mother's shoes next to
MOMMY'S SHOE daddy's pair)
MOMMY'S SHOES
MOMMY'S SHOES

TRANSCRIPT, Observational

Shannon
27 Oct 76 -2

SHANNON'S SHOES
SHANNON'S SHOES
SHANNON'S SHOES
M: No, they're mommy's shoes

510 UP-- UP
UP
UP
UP
UP (Mother picks Sh. up to nurse)

BELINDA?
M: Belinda went home

STAN?
M: Stan's still here

BYE-BYE STAN (Getting off mother's lap)

BANANA
BANANA

531 STAN BANANA?

BIKE (Getting on bike and riding to kitchen)

BANANA? (in ball to mother)
BANANA
BANANA

532 NO BANANA
NO BANANA
NO BANANA

JUICE
JUICE

533 JUICE
JUICE
JUICE
JUICE

/ / JUICE
/--/ JUICE (Mother is looking for little juice [illegible])

[illegible]LASS (pronounced /[illegible]ES/

536	ELEVEN HIGH	
		M: I think that was Shannon's juice
	FH-OH LID	
	FH-OH LID	(A jar lid fell on the floor)
537	SH-OH HIGH	(Pointing to a spill)
	FH-OH HIGH	
	/FH HH-/	
	FH OH HIGH	
	SH OH HIGH	
	FH-OH HIGH	
	FH-OH HIGH	
538		(Silence while Sh. drinks juice and then walks around kitchen looking at Stan)
539	HIGH	(Gaming juice for Stan)
	HIGH	
	BABY	(Picking up doll and showing Stan)
	BABY	
	BABY	
	BABY	
	BABY	
	BABY	
	BABY	(Getting mother doll)
	BABY	
	BABY	
	BABY	
	BABY	
540	TWO BABIES	
	TWO BABIES	
	TWO BABIES	
	TWO BABIES	
	BABY	
541	BABY BABIES	
	BABY ALIGN	
	BABY	
	TWO BABIES	(Giving Stan the two dolls)
	BABIES	
	BABIES	

540		(Silence, Sh. wanders around bedroom)
541	BIG-PUMPKIN	(Bringing a pumpkin to Stan from nursery with exaggerated effort)
	BIG-PUMPKIN	
	BIG-PUMPKIN	
	BIG-PUMPKIN	(pronounced /BI EAEIN/)
542	BIG-PUMPKIN	
543	BABY PUMPKIN	(Has been playing with doll, Stan has put one doll on the pumpkin)
	BABY PUMPKIN	
	BABY PUMPKIN	
	BABY PUMPKIN	(pronounced /BEBI FAKIN/)
	MOMMY?	(Sh. tries to put second doll on top of the first on the pumpkin, but Sh. sees it won't sit there and drops it)
	MOMMY?	
	MOMMY	
	MOMMY	
	MOMMY	
	MOMMY	
	MOMMY	
544	BABY SHOES?	(Said with marked uncertainty: Stan has put the second doll in father's sneaker)
	BABY HEAD!	(Said insistently, as if arriving at the right description of doll in sneaker)
	PUMPKIN	(Stan has placed the pumpkin on a sneaker, Sh. is naming this very hesitantly)
		(Sh. abandons the description game, going to hall to greet mother who has returned from basement)
545	HI	
	DADDY?	
		M: Daddy's at school
	STAN	
		M: Stan's in the bedroom
	HI	
	/GIGO/	
	HIGH	
		M: More juice

546	(O DOPE HIC) (O HIC) (O /—/ HIC)	
	UP MOMMY UP UP UP	
		M: You don't want juice?
	BANANA	
		M: Want a banana?
	(O BREAD	
		M: Want some bread?
	(O CEREAL	
547	CEREAL CEREAL CEREAL CEREAL CEREAL CEREAL CEREAL	
		M: I'll give you some of my cereal
	MY CEREAL My CEREAL My CEREAL	
		(Eats some of the dry granola)
550	/MAIN HAM/ /MAIN HAM/ /MAIN HAM/	(??)'
	BABY BABY BABY	
		(Pointing to teddy bear, naming him for Sean)
552	(cries) (O (O	
		M: What's the matter
	(O WET (O WET (O WET (O WET (O WET (O WET (O WET (O WET (O WET	M: are you wet?
		(Whimpering while mother check diaper)

553	BOTTOM BOTTOM BOTTOM	(In nursery, at changing station)
	FECES FECES FECES	
		(Mother takes one of Sh.'s socks off)
	SOCK ON	M: Sock off
	SOCK ON	M: Sock off
	SOCK ON	M: Sock off
	SOCK ON	M: Sock off (Removing other sock and pants)
	SOCK ON	M: Sock off
554	FECES FECES FECES FECES FECES FECES FECES FECES	
	PIN?	
	PIN	
	FECES FECES FECES	
	FECES FECES	
		M: Wash bottom (I driving Sh. to bathroom)
	WASH WASH BOTTOM WASH BOTTOM WASH BOTTOM	

555	WASH	
	WASH	
	WASH	
	WASH	
	WASH	
	A BOTTOM	M: Yes, it is
	A BOTTOM	
	A BOTTOM	
556	(cries)	
	/ae/ BOTTOM	
	/ae/ BOTTOM	
	(cries)	
557	FECES	
	FECES	
	UP	
	UP MOMMY	
	UP	
		M: First put on some cream and a diaper
558	UP	
	UP MOMMA	
	(cries as mother puts on cream)	
559		M: There!
	THERE	
	SHANNON PINS	
	SHANNON PINS	
	STAN PINS	
	STAN PINS	
	STAN PINS	
	MAMA PIN	
	MAMA PIN	
	MAMA PIN	
	MAMA PIN2	
	MAMA PIN	
	MAMA PIN	
	SHANNON PIN	

600		(Putting clothing back on)
601	MOMMY	(Giving a book to Mother)
	MOMMY	
	SHANNON	
	/Gae/	(Naming something)
602	DOGGIE	(pronounced /GAGI/, each time pointing to an individual picture of a dog in the book and changing the referent each time although selection process may enumerate the same individual several times)
	DOGGIE	
	DOGGIE	
	DOGGIE	
	DOGGIE	
	DOGGIE	
	DOGGIE	
	DOGGIE	
	DOGGIE	
	DOGGIE	
	DOGGIE	
	DOGGIE	
	DOGGIE	
603	UP	
	UP	
	/A BO/	(??) (Mother leaves for kitchen)
	/A BO/	
	CEREAL	
	CEREAL	
	NO CEREAL	
	NO CEREAL	
	NO NUTS	(Making an emphatic statement)
	NO NUTS	
	NO NUTS	
604	NO NUTS	(Begins singing intonation pattern through this sequence, very stylized)
	NO NUTS	
	NO NUTS	
	NO NUTS	
	NO NUTS	
	GO NUTS	(Following mother toward pantry)
	NO NUTS	
	NO NUTS	

M: Let's find the tea, Shannon

FIND TEA
FIND TEA
FIND TEA
TEA
A TEA (Dropping the tea tin)

605 STAN TEA
MAMA TEA?
MAMA TEA
STAN TEA
STAN TEA
STAN TEA

606 M: Now we need hot water
HOT
HOT

CEREAL (Running in pantry)

607 TEA (Finally putting the tea in the pantry)

M (Picking up her bowl of cereal)

608 (Mother gives her a bowl of grandpa's cereal)

SEE (?? intention of this unclear)

609 BIKE OUT BIKE (Discovering bike overturned in center of Kitchen)

(Sets the bike aright and then trades bowls of cereal)

610 MAMA'S CEREAL

/I I I/ (??) (Spoken to Tambat with a mouth full
/I I I/ of cereal)

611 DOOR (Doorbell rings. Angela, a neighbor girl a bit to wall the dog?

ANGELA?

HI
HI

HI
HI
HI
M: Leash (Looking for dog leash)
LEASH
LEASH

612 /BIA Dal/ (??) (To Angela on the porch)
/BIA Dal/
/BIA Dal/
/BIA Dal/
/BIA Dal/

613 MOMMY
MOMMY (Mother is in basement looking for leash)
MOMMY
MAMA
MAMA

ANGELA (Mother returns and sends Angela to find leash)

614 DAY
NIGHT (Pointing toward picture window--it's rather dark out)
M: It's kind of in between
NIGHT
NIGHT (Insistently)

M: Oh, so you say it's night, huh?

615 DOGGIE (Hearing them bark outside with Angela)
DOGGIE
DOGGIE!
DOGGIE!
DOGGIE! (Looking under curtain out window)
DOGGIE

616 ANGELA?
ANGELA?
ANGELA?
ANGELA?

ANGELA

LEFT OU (Trying to tie a belt around the bike)
LEFT OU

	BELT ON	M: Belt on bike?
	BELT ON	(Mother ties belt on)
	BELT ON	
	BELT ON	
617	BIKE	(Rides around kitchen
	BIKE	
	BELT ON BIKE	
	BELT ON BIKE	
	BELT ON BIKE	
	ON	
	BELT ON	
	BELT ON	
618	TEA	
	TEA	
	STAN SPOON	
	STAN SPOON	
	SHEILA SPOON?	
	STAN	
		(Reaches for a knife)
		M: No, that's sharp
619	SHARP	
	MAMA MATCHES	
	MAMA MATCHES	
	MAMA MATCHES	
	MAMA MATCHES	
	MAMA MATCHES	
	MAMA MATCHES	
	MAMA MATCHES	
	MAMA MATCHES	
	STAN MATCHES	
	MAMA MATCHES	
	MAMA MATCHES	
	UP	(Asking to nurse)
	UP MORE	
	UP MORE	
	UP MORE	
	UP	

	MAMA COFFEE	(Mother is drinking coffee and Stan is drinking tea)
	MAMA COFFEE	
	MAMA COFFEE	
	MAMA COFFEE	
	MAMA COFFEE	
	MAMA TEA	
	MAMA COFFEE	
	MAMA COFFEE	
	MAMA COFFEE	
	HOT	
	HOT	
	MAMA TEA?	
	MAMA TEA?	
	MAMA COFFEE	
	MAMA COFFEE	
	MAMA COFFEE	
	STAN TEA?	
	MAMA COFFEE	
	STAN TEA	
	MAMA COFFEE	
620		(Nurses)
621	MAMA COFFEE	
	MAMA COFFEE	
	MAMA COFFEE	
	MAMA HOT	
	MAMA HOT	
	MAMA HOT	
	MAMA HOT	
	STAN TEA	
	STAN TEA	
	STAN BREAST	(Said to mother while nursing)
	STAN BREAST	
	STAN BREAST	
	STAN BREAST	
	STAN BREAST	
	STAN BREAST	
	STAN BREAST	
622	STAN TEA	
	STAN TEA	
	STAN TEA	
	MAMA COFFEE	
	SHANNON COFFEE	
	SHANNON COFFEE	
	BABY COFFEE?	(Putting tablecloth on the table)

	BABY HUG	(wanting to hug the teddy bear)
	BABY HUG	
	BABY BREAST	
	BABY BREAST?	
	BABY BREAST?	
	SHANNON BREAST	
	SHANNON BREAST	
	SHANNON BREAST	
6'3	STAN TEA	
	STAN COFFEE	
		M: Stan no coffee
	STAN TEA	
6'4		(Doorbell rings, Angela brings Irish setter in)
6'5	ANGELA	
	ANGELA	
	ANGELA	
	ANGELA	(Fussing, waiting for Angela to come in)
	ANGELA	
	ANGELA	
	ANGELA	
	ANGELA	(End of measured hour)

Additional observations after measured hour:

	NO PAT-PAT BRANDY	(Brandy-Irish setter)
	ANGELA BACK DOOR	(Angela was at the back door with other dog)
		(Sitting on mother's lap, looking at Sh.'s chair)
Later:	MY CHAIR	
		M: Your chair
	MY CHAIR	
		M: Your chair
	MY CHAIR	
		M: Your chair
	MY CHAIR	
		M: Your chair

	MY CHAIR	
		M: Your chair
	MY CHAIR	
		M: Your chair
	MY CHAIR	
		M: Your chair
	MY CHAIR	
		M: Your chair
Later:	FLOOR?	(Asking permission to put juice glass on floor)
	SHANNON FLOOR?	(Sh. sits beside juice glass on floor)
	STAN FLOOR	
		M: Stan's in the chair

555 — Sh. has just awakened from a nap and is still sleepy. Mother and father have just left the house, leaving her with Stan. Sh. is uncertain, separation anxious, silent, and fingering a yellow crayon.

Stan: Whatcha got? Crayon?

599 CRAYON

Stan: What's that? (piece of crayon wrapping)

PAPER
PAPER
PAPER

597 EH
EH

PAPER — Stan: More paper

MORE PAPER

Stan: Want to eat some soup, Shannon?

SOUP

Stan: Want to eat some soup?

NO SOUP
NO SOUP

598 MAMA BACK

599 — (Silence, Sh. peeling back paper of crayon, turns quickly and bumps head on clip board)

Stan: Ow-oh, bump head

BUMP IT

PIECE A PAPER — (Handing Stan another piece of paper)

600 GO
GO — (Wiping off piece and to finger)

CRAYON
PIECE PAPER
OH-OH — (Paper still stuck to finger)

MOMMY BACK

601 MOMMY BACK?
MOMMY BACK?
DADDY BACK?

SOUP — (Trying to climb into high chair)

602 TRAY ON
TRAY ON

PEA
PEA — (Fingering peas in soup)

(Eats silently)

603 NO
NO — (Pushing bowl away)

MOMMY BACK
MOMMY BACK
DADDY BACK

BEAN — (Fingering a pea, although there were lima beans)

604 MAMA COME BACK
MAMA COME BACK
DADA COME BACK

605 — Stan: Soup?
NO SOUP
Stan: No soup
NO SOUP
NO SOUP

606 — (Silent, manipulating yellow crayon)

607 MAMA COME BACK
Stan: Want to get down?
NO SOUP
Stan: Want to get down?
SIT DOWN

608 MAMA COME BACK? (Walking around kitchen
MAMA COME BACK?
DADA COME BACK
MAMA COME BACK?
MAMA COME BACK

609	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
		Stan: What's that? (Attempting to distract her with toy)
610	ELEPHANT	
	ELEPHANT	
	ELEPHANT	Stan: Boy elephant
	ELEPHANT	
	ELEPHANT	
	MAMA COME BACK	
611	EARS	
	EARS	
	EARS	
	EAR	
	BABY COME--	
	ELEPHANT COME BY--	
		(Stan takes her bike to distract her, her voice getting shakey, uncertain)
	BIKE	
	BIKE	
		(Stan puts elephant on the bike)
	BABY ELEPHANT BIKE	
612	MAMA COME BACK	
	MAMA COME BACK	
	ELEPHANT BIKE	(Fingering cassles on handlebar)
	ELEPHANT BIKE	
		Stan: What's that (cassle)
		(Indicating she doesn't know)
	ELEPHANT BIKE	(Indicating the elephant with her record)
	/EE/	
	/EE/	
	(Unclear)	
	MAMA COME BACK	
	MAMA COME BACK	
613	MAMA COME BACK	

	MAMA COME BACK	
	DADA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	BABY	
614	PAPERS	(Stan is fumbling with his note pages)
	PAPERS	
	PAPERS	
	PAPERS	
615		(Ron, her uncle, comes upstairs into kitchen)
		Ron: Want any of your soup, Shannon?
	NO SOUP	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
616	STAR'S	(Indicating his pocket of star)
	STAR'S	
	STAR'S	
		Stan: Yes, you want some?
		(Shakes drink and sips)
	STAR	
617	STAR'S	
	STAR'S	
	STAR'S	
	STAR'S	
	STAR COME BACK	

STAR'
STAN'S
STAN'S
STAN'S
STAN'S
STAN'S

615 STAN'S
STAN'S
STAN'S
STAN'S

STAN'S WINE
STAN'S WINE
STAN'S WINE
STAN'S WINE
STAN'S WINE
STAN'S WINE
STAN'S WINE
STAN'S WINE
STAN'S WINE

619 STAN'S WINE

MAMA COME BACK
MAMA COME BACK
MAMA COME BACK
STAN'S WINE
STAN'S WINE
STAN'S WINE
MAMA COME BACK
MAMA COME BACK

620 MAMA COME BACK?
MAMA COME BACK?

(Cries)

MAMA COME BACK

DOGGIE
DOGGIE

(Looks "Hey" [observer's head or face])

621 DOGGIE HEAD
DOGGIE HEAD

DOGGIE
STAN HEAD
DOGGIE HEAD
DOGGIE HEAD

622 DOGGIE
DOGGIE HEAD

/--/ CRAYON (Rolling yellow crayon on floor)

ELEPHANT

MAMA-- MAMA COME BACK

/--/

623 NO
NO
NO (Putting crayon into electric heating floorboard)

YELLOW
YELLOW (Drops it into floorboard)

YELLOW

YELLOW
YELLOW

624 YELLOW
YELLOW

/ -/

SHANNON (Leaving floorboard)

STAN WINE
STAN WINE

ELEPHANT
ELEPHANT
ELEPHANT (Gives elephant big hug)
ELEPHANT

ELEPHANT
ELEPHANT

6'4	STAN: STAN WENT	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	MAMA COME BACK	
	ELEPHANT	
6'6	ELEPHANT	
6'7	ELEPHANT	
	/EA/	(Heavily palatilized: refers to a plastic letter, F)
	/EA/	
	BE COKE	
	ME COKE	
	ME COKE	
	COKE	
		Stan: You want a coke?
	COKE	
6'8	SHANNON COKE	
	SHANNON COKE	
	SHANNON COKE	
	SHANNON COKE	
	SHANNON COKE	
	SHANNON COKE	
	SHANNON COKE	
	COKE	
	SHANNON COKE	(Stan is preparing a coke for her)
	SHANNON COKE	
	COKE	
	COKE	
	COKE	
6'9	COKE	
	COKE	
	COKE	
	MAMA COME BACK	

630	COKE	
	COAT	
	COAT	
	COAT	
		Stan: Coat?
	COAT	
	NO COAT	
	NO COAT	
	NO COAT	
	COAT	
	NO COAT	
	NO COAT	
	COKE	
	COAT	
	NO COAT	
	NO COAT	
	NO COAT	
	COKE	
	COKE	
	COKE	
		Stan: What's that?
	ICE	
631		(Playing with the ice)
632	MAMA COME BACK	
	ACORN	(Finding an acorn on the floor)
	ACORN	
	ACORN	
	ACORN	
	MAMA COME BACK	
	ACORN	
	ACORN	
	ACORN	
	ACORN	
633	ELEPHANT	
	ELEPHANT	
	ELEPHANT	

ELEPHANT
ELEPHANT

ELEPHANT /DUN/
ELEPHANT /DUN/

ELEPHANT
ELEPHANT
ELEPHANT

636 OH-OH ELEPHANT
OH OH ACORN
OH OH ACORN
ACORN

643 ACORN
ACORN

OH-OH ACORN
ACORN
OH-OH ACORN
OH OH ACORN (Trying to put acorn into floorboard)
OH OH ACORN
OH-OH ACORN

(Drops it in)

OH-OH ACORN

646 Stan to Ron: The registers around here are going to be full of shit, aren't they?

SHIT
OH-OH SHIT
OH OH SHIT
OH-OH SHIT

/- /

MAMA COME BACK

647 / /

648 HEAR YOU
HEAR YOU (Handing an acorn to Ron)

ACORN

649 TWO ACORNS (Looking at two acorns she has paired)
TWO ACORNS
TWO ACORNS

Ron: Did you find /KA/?

/KA?/
/KA?/
/KA?/
/KA?/

650 NO

Ron: Who about the monicka?

MONICKA?
MONICKA?

/MaISKA/ (??)
/MaISKA/
/MaISKA/
MONICKA
MONICKA (Ron gives her a harmonica)

651 (plays harmonica)

Ron: What's this one? (A plastic letter, O)

/A/
/A/
/A/

MAMA COME BACK
MAMA /KAMIN/ BACK (This inflection very clear)

(Plays with acorns)

652 NO
NO (??) (Directed to Ron)

MAMA COME BACK
MAMA COME BACK

(Plays)

653 MAMA COME BACK
MAMA COME BACK
MAMA COME BACK
MAMA COME BACK

MAMA COME BACK
MAMA COME BACK
MAMA COME BACK
MAMA COME BACK
MAMA COME BACK
MAMA COME BACK
MAMA COME BACK
MAMA COME BACK

644 (Playing silently)

645 /--/ (Laying on floor, with hand in mouth, talking to herself, not intended to be interpretable to Stan or Ron

DADA /--/
DADA /--/

646 /--/ (Laying on floor, playing harmonica)

647 /ZIaLA/

SHEILA (pronounced /Zla/

MAMA SHEILA (Rolling over, looking at Stan but still speaking to herself)

SHEILA
SHEILA

648 /--/ (Begins playing the harmonica, long tones)

650 -MORICLA

MATCHES (Ron lights a joint)

NO MATCHES
NO MATCHES
NO MATCHES
MATCHES

651 MAMA COME BACK
MAMA COME BACK

(Plays harmonica)

652 (Stan picks up a doll)

BABY
BABY

BABY
BABY

/Ba/ (Muttering to herself)
/Ba/
/Ba/
/Ba/
/Ba/
/Ba/

653 BABY SIT ON (Stan has put the doll on the electric floorboard)
BABY SIT ON

BABY /--/

654 BYE-BYE (Ron leaves for basement)

MOMMY
MOMMA
MOMMY?
MOMMY?
MOMMY?
MOMMY?

MOMMY COME BACK?
MOMMY COME BACK?
MOMMY COME BACK?
MAMA COME BACK
MAMA COME BACK

Stan: Mama will come back later

LATER?

(Ron returns with two small pumpkins)

BIG PUMPKINS
BIG PUMPKINS
BIG PUMPKINS
BIG PUMPKINS
BIG PUMPKINS
BIG PUMPKINS
BIG PUMPKINS
BIG PUMPKINS

655 PUMPKINS
PUMPKINS
BIG PUMPKINS
BIG PUMPKINS

BIG PUMPKINS
PUMPKINS
STAN PUMPKINS
STAN PUMPKINS

PUMPKINS
BIG PUMPKINS

TWO
TWO PUMPKINS (End of measured hour)

705	CATS	(Mother has left Shannon at our apartment.
	CATS	Sheila and Shannon are in the kitchen
	CATS	making play dough.)
	CATS	
	CATS	
	CAT	
	CATS	
	CATS	
	CAT	
		Sheila: Where's kitty?
	KITTY?	
	CAT	(as cat goes behind trunk to hide)
		Sheila: Mouse, Mouse come out
	MOUSE?	
707		Sheila: We need one cup of salt
	ONE CUP OF SALT	
	ONE CUP OF SALT	
	UH-OH	
	UH-OH	
	UH-OH	
	UH OH	
	UH-OH	
	UH OH	
	UH OH	
708		Sheila: We spilled some salt
	SPILL SOME SALT?	
	SPILL SOME SALT?	
	ONE?	(holding a measuring cup)
709		
710	ALL GONE	(fingering salt container)
711		(Sheila pours salt into large bowl)
		Sheila: We'll have to pour some more

	POUR SOME MORE? SAVE ALL GONE ALL GONE	
		Sheila: We'll have to put that one in the trash
	WASTEBASKET?	
712	SHOE	(grating her shoe on spilled salt)
713		(stirring mixture in bowl)
714		Sheila: You stirring it?
	STIR?	
	STICK	(fingering paste)
	OH-OH UH-OH	(spilled some paste on tray
715	UH-OH OH-OH	
	HOT	(as Sheila lights the stove)
716	DIRTY	(looking at paste fingers, fascinated by the feel)
	UH-OH	
717		(puts fingers with paste in mouth)
	No	(withdrawing fingers)
718	UH-OH	(shooing hands to Sam)
	No	(refusing) Sheila: Shannon, I think we have to cook that
	COOK IT COOK IT COOK IT	
	COOK THAT COOK THAT	
	COOK IT COOK IT	

	COOK IT COOK IT	
		Sheila: Do you like tuna fish?
719	TUNA FISH TUNA FISH	
720	COOK? COOK?	
		Sheila: Add some cheese?
	CHEESE	
	HOT	(as casserole goes into oven)
721		Sheila: How's it taste?
	TASTE	(tasting paste mixture)
722	OIL OIL OIL	(as Sheila gets vegetable oil)
	SPOONS	
		Sheila: We need four teaspoons of this
723	FOUR TEASPOON	
	ALL GONE ALL GONE	(as last teaspoon added)
724	SHEILA SHEILA SHEILA SHEILA	(taking spoons and wanting Sheila to help her)
	COOK IT COOK IT	
725	MAMA COME BACK?	
	TRAY DIRTY	
	DIRTY	
726		(Shannon walks onto the shot is covered with the play dough paste)

	NO	(remanding herself for standing on tray)
		(as she starts to step off tray)
		Stan: No (countermanding)
		Stan: Your shoes are dirty
		(hurries to clean them with paper towel)
	NO SHOE DIRTY	(stating mind)
727	TIRED? TIRED? TIRED?	(as Sheila rubs her eyes)
	OH-OH	
728	NO WALKING	(stating mind, looking at Stan, edging tray with foot)
	CRAYONS CRAYONS	(as food coloring bottles are removed from box)
729	OH-OH	(dropping food colorings to floor)
	UH"	
	I'M OH DROPPING COLORS	
	BEEP?	
730	MAKE PINK	(selecting red coloring)
731		(Sheila is stirring play dough paste in pan, Shannon squirts red coloring into mix)
732	SHEILA HAND SHEILA HAND	(Shannon notices red coloring has splashed on Sheila's fingers while stirring)
	OH-OH HAND OH OH HAND	
	OH OH RED OH-OH RED OH-OH RED OH OH RED	

	OH-OH RED OH-OH RED OH-OH RED RED RED	
		Sheila: What's red?
	RED FINGER	
733	HOT	
		Sheila: What did we make?
	RED FINGER	
		(Sheila takes hot pan of play dough outside)
		Sheila: We'll put it outside
	SIDE	
		(Sheila bumps her head on cabinet door)
734	SHEILA HEAD SHEILA BUMP IT? SHEILA BUMP IT? SHEILA BUMP IT?	
	SHEILA BUMP IT	
735	MAMA COMING BYE BACK--	(muttering to herself)
	MAMA COME BACK MAMA COME BACK MAMA COME BACK	
736	OH-OH	
	SHEILA BUMP IT? SHEILA BUMP IT? SHEILA BUMP IT?	
	SHOE	(as Sheila cleans up floor)
737	MAMA COME BACK? MAMA COME BACK?	
	MAMA COME BACK? MAMA COME BACK? MAMA COME BACK?	
	MAMA COME BACK	

738 SHEILA PLAY DOUGH
SHEILA PLAY DOUGH
SHEILA PLAY DOUGH
SHEILA PLAY DOUGH

MAMA COME BACK?

Sheila: Daddy's coming too

DADDY COME -

Sheila: Where's Ronnie?

RONNIE

Sheila: Where's Garth?

WHERE GARTH

Sheila: At home

740 BYE BYE
BYE BYE

Sheila: Yes, home is bye bye

MAMA COME BACK
MAMA COME BACK
MAMA COME BACK

740 MAMA COME BACK
MAMA COME BACK
MAMA COME BACK
MAMA COME BACK

Sheila: You can have your very own plate

/ / PLATE

741 GARBAGE
GARBAGE
GARBAGE

MAMA COME BACK?

742 EH?

Sheila: This is garlic

GARLIC
GARLIC
GARLIC

Sheila: You can throw it away if you want

TO
MAMA COME BACK

743

Sheila: You want to help set the table

SET TABLE

COME DOWN
COME DOWN

UH-OH COKE

STAN'S
STAN'S
UH-OH COKE

744 Sheila: Want your next plate?

/--/ NEXT PLATE
A TABLE

Sheila: To the table

TO TABLE

745 Sheila: Who's plate?

STAN'S

Sheila: That's Shannon's plate

SHANNON PLATE
SHANNON PLATE

EH?

Sheila: That's a piece of avocado

AVOCADO?

Sheila: Want it?

/NO 'CADO/
/NO 'CADO/

746 Sheila: Want a fork or spoon?

FORK
SHANNON'S (pointing to plate)
UH OH (dropping fork)

747 SALT PEPPER

748 SPOONS?

STAN'S (carrying spoons)

749 NAPKINS.
NAPKINS?
NAPKINS?

CREEN ONES?

STAR? (offering napkin to Stan)
STAR?

750 Sheila: All right
ALL RIGHT

COKI

SHANNON PLATE
SHANNON PLATE
SHANNON PLATE

751 SHANNON PLATE THERE

COKE?
COKI

SALT
Stan: That one is pepper
STAN'S PEPPER
STAN'S PEPPER
STAN'S PEPPER

752 READY EAT (as Sheila serves casserole)

HOT
HOT
Sheila: Let it cool
COOL

HOT
HOT
NOT TOUCH IT
NOT TOUCH IT

NO TOUCH IT
HOT

753 COKI
COKI

COKI

NO TOUCH IT (as Shannon picks up her fork)

No HOT (tasting the casserole)
NO HOT

754 PEPPER?
MY PEPPER
MY PEPPER

HOT
COOL (touching lettuce)
COOL

HOT (touching casserole)
NO HOT (tasting casserole)
NO HOT

755 (eating)

756 NO PILLOW WET
PILLOW
NO PILLOW WET
NO PILLOW WET
Sheila: Good
GOOD

757 MAMA COME BACK

MAMA COME BACK?

COKI (pushing empty coke mug toward Sheila)
COKE
COKE
COKI
COKE
COKI
COKE
COKI
COKI
COKI
COKI
COKE
COKI
COKI
COKE
Sheila: Does Shannon want coke?

758 SHANNON COKI
SHANNON COKI

PEPPER
PEPPER

PEEPLE

PH OH COFF (spilling tranquilizers)
OH OH COKE
NO
PH-OH COKE
NO COKE

750 PH OH COKE
OH-OH COFF
PH-OH COKE
PH-OH COKE
PH- H COKE
PH-OH COKE
PH OH COFF
PH OH COKE
PH OH COFF

(drinks coke)

PH-OH COFF
PH OH COKE
PH-OH COKE

800 PH-OH COFF

EAT NOODLES
EAT NOODLES

PH-OH COFF
PH-OH COFF
PH-OH COKE

Sheila: Shannon, put your coke down

COFF /--/ DOWN

COFF DOWN
COFF DOWN
PH-OH COKE
STAN'S
STAN'S
PH-OH COFF

801 (Shannon belches)

SHANNON DO POOP

Stan: Did Shannon poop?

PH OH POOP
HAD SHANNON POOP
NO

802 MAMA COME BACK
MAMA COME BACK
MAMA COME BACK
MAMA COME BACK

DADDY-- COME BACK
DADA COME BACK

BYE-BYE
TOWEL OFF?
TOWEL OFF?
TOWEL OFF?

Stan: No, keep your towel on

803 TOWEL OH

Stan: These are our new pillows

NEW PILLOW
TOWEL ON

805 MAMA COME BACK?
MAMA COME BACK?
MAMA COME BACK?
SHANNON COME BACK
MAMA BYE BYE

805 ALL GONE
ALL GONE

PHILLY ALL GONE
SHANNON ALL GONE

NO COFF (Her mom is FULL term)
COFF ALL GONE
COFF MAMA

(Shannon drinks)

(End of second hour)

EATS

NO EAT EAT HAVE (Shannon plays with her)
NO EAT EAT HAVE (she does)
NO EAT EAT HAVE
NO EAT EAT HAVE

TRANSCRIPT, Recorded
Chronologic: 24 mo 26 da
Kennett Russell

Shannon
27 Nov 76 -1
5:45 p.m.

1. /IIN SOOOL. (PENCIL)

2. CEA-ONS

(Cough)

3. PAPER /IN IS/ (IN HIS)
4. /HIPER IN HIST/ (PAPER IN THIS)

5. PAPER IN HIS
6. PAPER /PIERI/ (IN HERE)

7. FIRI
8. /HI EP/

9. /PI PE/
10. FIRE
11. FIRE
12. MOMMA COOKIN DINNER

13. DADA COOKA DINNER

14. SO COOKIN
15. SO COOKIN DINNER
16. SO COOKA DINNER
17. /I/
18. /I/
19. /I/

(Shannon is tearing a piece of paper into little pieces)

1. What cya doing?
2. What are you doing, Shannon?
(continued tearing of paper. As I make notes Shannon notices the pencil.)

3. I need the pencil to write.
4. Why don't you get a crayon?
5. Why don't you get one of your crayons?

(Shannon is blowing the little pieces of paper she tore up around the table.)

6. /harmmp/ (I muttered something.)

7. You okay?

8. Paper in this, huh.
(Shannon is stuffing paper pieces into a little boy-like object.)

(Shannon continues to blow paper)

9. What?

10. Mama cookin dinner, yes she is.

11. So, I'm writing. I'm writing on a paper.

TRANSCRIPT, Recorded

Shannon
27 Nov 76 -2

20. /I/
21. /I I I/ (Possibly WRITE)

22. /DO/ PAPER
23. THIS PAPER
24. WRITE PAPER

25. WRITE PAPER
26. WRITE PAPER
27. WRITE PAPER
28. WRITE /DA/ PAPER (ON)

29. RONNIE
30. RON..

31. RONNIE

32. /O/DADDY
33. DADA HOME SHANNON

34. DADA /HO/..

35. MOMMA HOME SHANNON

36. BROKEN

37. /HI/

38. /HI/
39. MOMMY /GRO CII/ (GROCERY)

40. MOMMY /GE/GROCERY
41. APPLE HUICE

42. SHANNON APPLE..APPLE HUICE

43. APPLEJUICE

44. /O GO MIK O/ (And other assorted mutterings as she climbed down from the chair)

45. APPLEJUICE (shouted)

12. I'm writing on this paper.

13. Uh huhm.

14. Write on paper, that's what I'm doing.

15. Ronnie went to school.

16. Ronnie went to school.

17. Pardon?

18. Daddy's staying home with Shannon.

19. Yah.

20. It's not broken.

21. No

22. Did mommy get some groceries?

23. She got some applejuice.

24. Oh, you want some.

25. Okay, why don't you get down and come over here and ask for some applejuice, okay?

26. Yes, you can have some.

46. APPLEJUICE.

47. CUP

48. CUP
49. CUP
50. CUP

51. SHANNON'S
52. CUP JUICE SHANNON
(Shannon muttered a few single utterances that were too dim to pick up)
53. Mr JUICE

54. UP

55. CRAYONS.

56. CRAYONS
57. DADA WORK ON CRAYONS

58. PINK A ROSIE
59. RINK A ROSIE (Dimly, with other utterances that could not be heard)

60. RINK A ROSIE

61. RINK A ROSIE
62. RINK A ROSIE
63. RINK A ROSIE
64. RINK A ROSIE

27. You did get some didn't you? (to Helen)
28. Yes (Helen)
29. Mmm

30. Uh huh.
(Moving around to get Shannon some juice; some muttered adult conversation)

31. Cup (Helen)

32. Cup (Helen)

33. No juice, okay. (Helen)

34. Oh Shannon, come over here and do work on your crayons.

35. Yah.

36. No. I'll tell you what, I'll get your blocks, and bring them out here, okay.

37. In that space she said Rink a rosie and bye bye brie. (Helen)
(sigh)

38. She's saying it sort of softly (Helen)

65. RINK A ROSIE
66. /ON YA/ APPLEJUICE

67. HERES YOUR BLOCKS
68. /DI YA BREN DI/
69. /DI YA BREN DI/
70. SHANNON /DI/

71. Shannon /DEN TI/

72. SHANNON /DUR/ (the end faded out)
73. SHANNON /DUN TI/

74. SHANNON /DUN DI/
75. SHANNON /DUN DI/
76. SHANNON /DUN DA I/

77. BLOCKS
78. /GRE..AE..U/ GREEN

79. /GRE AN PLI WI BLOCS/
(mumbled and drawn out)

80. HELEN DO IT
81. /BABY DADDY/ (mumbled)
82. DADDY PLAY WITH BLOCKS

83. DADDY PLAY WITH BLOCKS
84. DADDY PLAY WITH TRIANGLE
85. DADDY PLAN WITH TRIANGL /RINK GO/
(Shannon continues but the sounds are unclear)

86. TWO
87. TWO

88. TWO BLOCKS

89. /AI/

39. It's over there on the table.
40. Here's your blocks.

41. Shannon what?

42. Shannon dirty?

43. No, what'd you say? (Helen)

44. Huh? (Helen)

45. Shannon didne? (Helen)
46. Hah. (Helen)
47. No, silly. (Helen)
48. Wanna play with blocks? (Helen)

49. Want to put green up on the table and play with blocks?

(dumping out the blocks)

50. Yah, I'll play with blocks Shannon.

(Shannon and I built quietly for fifty seconds.)

51. Oh, you have two blocks.

90. OH OH

91. UH..

92. KNOCK OVER
93. OH OH
94. UH OH

95. SHANNON /DID THEY
96. SHANNON TIRED

97. DADDY TIRED

98. MOMMY TIRED

99. NO

100. SO /IT A/ BAP
101. OF IT DADA

102. DADDY

103. KNOCK (pause)

104. OVER

105. KNOCK (crash) OVER
106. TEN BLOCKS

107. OH OH

108. KNOCK OVER
109. (Crash) SHANNON TIRED

110. BIG ONE

(She knocked down the pile.)

52. Uh oh.

53. You knocked them over, huh.

(Continuing to collapse blocks)

54. Shannon's tired.
55. Are you tired?

56. Daddy's not tired, no.

57. No. (Helen)
58. Shannon want to take a nap? (Helen)

59. No.

60. Put it on it? (pile blocks)

(crash)

61. (crash) Knock, huh. (crash)

62. Knock over (chuckle)

63. There is one
64. Two
65. Three
66. Four
67. Five
68. Si
70. Seven blocks

71. (crash) Knocked em over

72. Is Shannon tired

73. A big block, yeh.

111. BIG BLOCK
112. LITTLE

113. LITTLE
114. BIG BLOCK

115. BIG..BIG BLOCK

116. LITTLE BLOCK

117. BIG BLOCK

118. BIG ONE

119. BIG..LITTLE BLOCK

120. LITTLE BLOCK

121. LITTLE BLOCK

122. LITTLE BLOCK

123. BIG BLOCK

124. LITTLE BLOCK

125. BIG BLOCK

126. /BAG YEG ENE YOW/

127. /BAG IN YEN YOEW/

128. NO

129. TRIANGLE

130. KNOCK OVER
131. KNOCK OVER

132. KNOCK OVER

133. DADDY

74. A little block

75. A big block

76. A big block

77. A little block

78. A big block

79. A big block

80. A little block

81. A little block

82. A little block

84. Is that a little block

84. A big block

85. A little block

86. A big block

87. What is that?

88. Bae in yew?

89. Triangle? (Helen)

90. A triangle

91. Well, you've got to build some thing before you can knock it over.

92. I'm sure Sean is loving all these crashing sounds. (Crash)

94. -

134. DADD

135. DADDY

136. DADDY

137. DADDY

138. DAD /YEEEE/ DADDY (drawn out)

139. UH OH

140. /PLES/

141. THANK YOU

142. /OOH/
143. /OHORS/ (drawn out HORSE)
144. HORSE (reaching for other one)
145. HORSE

146. HORSE

147. /HAH/ MOM CAR (identifying piece)

148. HORSE

149. COW

150. COW..
151. HORSE (picking up another piece)

152. COW (pointing)

153. TWO HORSE
154. TWO HORSE

(offering block)
94. Thank you
95. For giving me the blocks.

96. Oh, thank you.

97. Thank you

98. Thank you (drawn out)

99. Oh, thank you

100. (crash) Uh oh.

101. Oh, thank you

102. Oh, you're welcome. (moved pieces around)

103. Is there a horse

104. Let's see.

105. Mommy's car.

106. I think that's a cow.

107. Cow

108. Let's see
109. That's a horse, no.

110. That's a cow.
111. They look much the same.

112. Well, actually it's one horse and one cow.
113. But the difference is only these little wavy lines here.

155. HORSE

156. COW

157. HORSE
158. HORSE

159. COW

160. /MOMMIE KI/

161. /AH/ (WHAT)

162. /DO DO WE/

163. /RRRR/ (doing the same)
164. /RRRR/
165. /RRRR/

166. /RRRR/
167. /RRRR/
168. UH OH

169. MOMMY'S CAR

170. MOMMY'S CAR

171. MOMMY'S CAR
172. MOMMY'S CAR /RR/ (banging)
173. UH OH (hitting horse) HORSE

174. /EH/
175. PAPA ECT

114. Yes, that's a horse.

115. Cow
116. You can really distinguish them, huh.

117. Yeah
118. That's a horse.

119. Cow
120. You're getting pretty abs..

121. Hmmm
122. Look at this, Shannon
123. Look at this. (construction)

124. Oh, gee, that's too bad.
125. I thought you could run right up that /um thi wly un/ auto, but you can't.

126. That block doesn't do it good, does it.
127. (crash) Let's see if that works.
128. Here ya go, rmmm. (pushing cars around)

129. Uh hmm

130. Uh oh I right. (crash)

131. What

132. Mommy's car, yes.

133. Uh oh, boo.e

176. DADA EFCTS
177. DADA EFCTS

178. /DO DO DA DA GO/ EFCTS
179. /DA DA GO/ EFCTS
180. /EM BOMB/

181. DADA /DAT/ (THAT)

182. /EI ANG GIOL/ (TRIANGLE)
183. /TRANGANG GIOL/ (TRIANGLE)

184. HAIR
185. TRIANGLE

186. HAIR'S ON TRIANGLE
187. HAIR /ANGEL/ (TRIANGLE)
188. TRIANGLE
189. TRIANGLE
190. TRIANGLE
191. TRIANGLE
192. TRIANGLE

193. TRIANGLE
194. BLOCK

195. /BE ANGEL/
196. MILK ALLGONE

197. MILK ALLGONE

198. /AH/
199. DADDY

200. /OOH EFAND/
201. SHANNON TAKE NAP

202. HORSE (picking up pieces)
203. COW

204. HORSE

135. I don't think dada do any feces.

(moving blocks around)

(urging my destructive participation)

135. A triangle, yes.

136. Hair's on the triangle.

137. A triangle, yes.

138. A block.

139. Is your milk all gone?

140. Oh.

141. Thank you

142. Shannon take a nap.
143. Are you goin to lay down there and take a nap?

144. Now

145. Her c

205. CAR
206. CAR
207. MOMMY'S CAR

208. HORSE
209. HH OH COW
210. HH OH
211. HH /OW/ COW
212. HH OH
213. /BRRRRM/ (revving up)
214. BOOM
215. BOOM
216. BOOM

217. HORSE GO BOOM

218. /NEIGH/

219. /EH/ (complaining

220. /EH/
221. /HUH/

222. /EH EH/

223. /MEH/

224. MUSIC

225. SAYING

226. TAPE RECORDER

146. Mommy's car

147. Boom?

148. Horse go boom?
149. I don't think horses go boom.
150. Horses go (neigh)

151. Cars go varoom, varoom, varoom.
152. Or is that a cultural thing.
153. Do some places do horses go boom?
(changing the tape to side two)
154. We have to tape till its all done.

155. Okay

156. Please

157. Just accept what I said there, okay.

158. I'll let y... I'll let you play with it when its all over.
159. All right

160. No, there's going to be no music coming out of the tape recorder.
161. Because I'm tape recording what you're saying.

162. Which isn't a terrible amount

163. You want the tape recorder?

227. TAPE RECORDER

228. TAPE RECORDER
229. TAPE RECORDER

230. TAPE

231. DADA..
232. /IA HO/ DADA FOLD IT
233. DADDY FOLD IT
234. DADDY FOLD IT
235. DADDY..

236. DADA FOLD IT

237. DADA FOLD IT

238. HOW'S THAT
239. DADA PAPER

240. YOU FOLD IT

241 ALL FOLDED
242. DADA FOLD IT

243. FOLD IT UP
244. FOLD UP RIDE A POST
245. FOLD UP
246. FOLD OFF
247. FOLD OFF RIDE A HORSE
248. FOLD OFF

249. FOLD IT.
250. FOLD OF

164. You can have it in (pause) 20 minutes, okay.

165. You can have it in 20 minutes.
166. You can't have it now.
167. All right.
168. Do you like to blow the paper around on the table?

169. Eh hoh.

170. Daddy told it, okay.

171. I'll fold the paper for you.
172. How's that?

173. Oh, another one?
174. All right
175. How's that?

176. Oh

177. okay
178. All folded

179. All right

180. Told it off for ring around the rosie.

181. Told it on.

182. Fold it off means you're opening it up and fold it on means you're closing it.
184. That is very interesting.
184. That's precisely the way they say they do things.
185. They attach a negative, you know.
186. Uhhmm. (Helen)
187. Usually at the beginning
188. But it's interesting that she makes off and on..

251. DADA FOLD IT (said firmly)

189. Okay.

252. DADA FOLD THAT

190. Dada told it or dada told this?

253. FOLD IT

191. Fold it, okay.

254. DADA FOLD IT

192. All folded

255. ALL FOLDED? (pointing to another piece)

193. No, that's not one that's all folded.

256. FOLDED

194. I folded that one, yes.

257. FOLDED

195. I folded that one, too.

258. FOLDED

196. I folded that one, too.

259. FOLDED
260. /HMMM/
261. SHANNON
262. /HI NOT HMM MMM/ COFFEE (I WANT)

197. You want some coffee?
198. Just a sip.

263. /NO/
264. /HE NOT/ COFFEE
265. NO HOT

199. Nope, the coffee isn't hot.
200. You're right
201. But it's all gone now.

266. COFFEE

202. It's all gone

267. COFFEE

203. All gone

268. COFFEE
269. COFFEE
270. DADA

271. SHANNON DRANK IT

272. ALLGONE

273. /HM..HM/ COFFEE (taking last sip)
274. ALLGONE

275. TEN MINUTES

276. COFFEE

277. COFFEE ALLGONE

278. I'll OIL PAPERS

279. I'll OIL PAPERS

280. TOUCH PAPERS
281. SHANNON GET PAPER? (getting down on the floor and touching floorboard heater)
282. /HH/ HOT
283. HOT
284. HOT

285. HEATER HOT

286 TOUCH HEATER

204. I drink it, yes I did.

205. You..You wanna take the last swigs, the dregs.

206. All gone, yes.

207. Uh hmm.
208. I..I'm holding it up so it doesn't fall over. (tape recorder)
209. Oh no, don't touch it, Shannon.
210. You don't wanna step the tape recording.
211. You can touch it in 10 minutes.

212. Yeah

213. No, coffee's all gone.

214. If you get down from the chair I'll let you take the coffee cup to mommy.

215. Did..

216. Did you drop the paper on the floor.
217. Don't worry.

218. The heat's hot, huh.

219. Did you.. you touch the heater?

220 Did you touch it?

287. TOUCH IT

288. MOMMY DADA

289. DADDY DADDY

290. COFFEE ALLGONE

291. CUP /T/ MOMMY

292. DADDY'S

293. COFFEE ALLGONE

294. UP MOMMY
295. TIE SHOE
296. TIE SHOE
297. TIE SHOE
298. TIE SHOE

299. TIE SHOE
300. SHOE
301. SHOE
302. SHOE
303. SHOE
304. SHOE
305. SHOE
306. SHOE
307. SHOE /DZ/ (drawn out SHOES)

308. SHOE
309. BLOCK

310. TRIANGLE
311. TRIANGLE

312. TRIANGLE

221. Yeah

222. Oh, thank you

223. Thank you

224. Coffee's all gone.
225. You're going to take the cup to Mommy, huh.

226. Okay

227. Thank you. (Helen)

228. Daddy's coffee all gone. (Helen)
229. Okay. (Helen)
230. Okay
231. Surprised she didn't say okay, since we use that word about a hundred times..

232. Okay, I'll tie your shoe.

233. Is this a shoe?

234. It's a block.

235. Yes, it's a triangle like that one.

236. Umhm.

237. That triangle is a block and that triangle is a..is from a puzzle.

313. TRIANGLE PUZZLE

238. No, that one's from the puzzle.
239. You know what puzzle that is.

314. PUZZLE

240. Yeah, it's from this puzzle.

315. /UHH/

241. Yeah

316. PUZZLE

242. We can put that away real good
243. Does that fit in the puzzle?
244. Try it.

317. /UH/ PUZZLE

APPENDIX B

TRANSCRIPT, Recorded
Chronologic: 11 yrs 10 mo 15 da
Susan Dick

Janice
21 July 75 -1

(Janice and clinician were seated in a therapy room, informally conversing while Janice drew on a blank paper.)

1. YEP
2. /UH UH/
3. BLACK
4. BLACK
5. BLACK
6. NOT PURPLE
7. NOT BLUE
8. BLACK
9. WRITE ON A PAPER
10. /UH UH UH UH UH UH UH/
11. NOT RAINING
12. NOT RAINING
13. ALL GONE
14. TOO BAD
15. TOO BAD
16. THAT'S IT
17. THAT'S IT
18. RAINING OUT?
19. SUN
20. ALL GONE
21. RIGHT THERE (pointing outside)
22. GO AWAY
23. GO AWAY
24. THAT'S IT
25. TOO BAD
26. TOO BAD
27. GO /XXXX/
28. WHAT JANET
29. WHAT
30. WHAT
31. WHAT
32. WHAT
33. WHAT
34. WHAT
35. WHAT
36. WHAT
37. WHAT
38. WHAT
39. WHAT
40. WHAT
41. WHAT
42. WHAT
43. WHAT
44. WHAT
45. WHAT
46. WHAT
47. GET OVER THERE RIGHT NOW (hums a bit)
48. YOU STOP THAT RIGHT NOW
49. YOU GET OVER THERE RIGHT NOW
50. COME ON
51. NO
52. NO (begins to laugh)
53. PURPLE
54. NOT PINK
55. PURPLE

1. Janice color?
2. Janice is coloring.
3. Janice, do you want another color?
4. Another one?
5. Janice open the pen.
6. The pen is black.
7. What's Janice doing?
8. What's Janice doing?
9. Janice, do you want another color?
10. Janice closed the pen.
11. Janice open the pen.
12. Janice is the sun out?
13. No, it's not raining.
14. All gone?
15. Too bad.
16. The rain's all gone?
17. No.
18. The sun is out.
19. The sun is shining.
20. What's all gone?
21. The rain is all gone.
22. Go away.
23. That's it.
24. Janice do you want another color?
25. Thank you.
26. Janice calm down, just calm down.
27. Turn the paper over?
28. Oh, start a new picture.
29. The color is purple?
30. What is Janice doing?

TRANSCRIPT, Recorded
Chronologic: 11 yrs 11 mo 7 da
Susan Dick

Janice
13 August 75 -1

(Janice and clinician were seated in a therapy room, informally conversing while Janice played with doll.)

1. OH (laughter)

   (laughter)

2. YEA

   (laughter)

3. TAFF OFF

4. DOLLY
5. DOLLY

6. NOT DADDY
7. NO

8. SUSAN (pointing to clinician)

9. PINK (pointing to clinician's dress)

10. NOT PURPLE

11. THAT'S PURPLE (pointing to doll's dress)

12. NOT PINK

13. THAT PURPLE
14. PURPLE

15. YEA
16. GO SHIRT
17. GO

1. Hi Janice

2. Take dolly's dress off?

3. Janice is unzipping the dress.

4. Pull the dress off.

5. What's Janice doing?

6. Take off, taking the dress off.

7. Dolly, that's dolly.

8. Not daddy, her name is dolly.

9. Yes, this is Susan.

10. Susan is wearing a pink dress.

11. Not purple today.

12. Yes, that's purple.
13. Take the dress off?

14. There's pink in the dress too.

15. The dress has purple in it.
16. Janice is taking the dress off.

17. The door is closed.

TRANSCRIPT, Recorded

Janice
21 July 75 -3

56. DRAWING THE PURPLE

31. Drawing the purple.
32. Janice is coloring.
33. The pen is purple.
34. Susan is putting the pens in the can.
35. Put the lid on the can? No?
36. Not done?
37. What is Janice doing?

57. DRAWING THE PURPLE

18. SHIRT	18. Do you want to put the shirt on?
	19. Or do you wanna put the dress on?
	20. Open the door?
	21. Janice come sit down.
	22. Come sit down.
	23. I'll get the shirt.
	24. Finish undressing dolly.
19. OUCH	25. Sit down, good girl.
	26. Susan is getting the shirt.
	27. You want this shirt?
20. YEA	28. Alright, Janice has to wash dolly first.
	29. Take the shoe off?
21. /SHHHHHHHHHHHHHHHH/	30. What's Janice doing?
22. TAKE SHOE	31. Taking the shoe off.
23. /XXXXXXXX/	32. Janice took the shoe off.
24. WATER	33. Yes, there's water on the towel.
	34. What's Janice doing?
25. TAKING PANTS ON DOWN	35. Taking pants off
	36. Pants off
26. HERE ROOM	
27. ROOM	37. Janice is in the speech room.
	38. What's Janice doing?
28. WASH	39. Washing dolly.
	40. Janice is washing dolly.
	41. Another one?
29. YEA	42. Janice is washing dolly.
	43. Janice is washing dolly's leg.
	44. Janice is washing dolly's tummy.
30. SUN OUT	45. The sun's out today?
31. IN HIM	46. Is it raining? No.
32. ALL GONE RAIN	47. No rain today.

	48. All gone the rain.
33. TOO BAD	49. No rain today.
34. TOO BAD	
35. NO PURPLE SKIRT TOMORROW	50. No purple skirt tomorrow?
	51. Well maybe.
	52. Janice is not wearing a skirt today.
36. SKIRT TOMORROW?	53. Maybe, maybe a skirt tomorrow.
	54. Janice maybe wear a skirt tomorrow.
37. YES	
38. YOU A GOOD GIRL	55. Janice is a good girl.
39. NO LONG DRESS	
40. NO	
41. SHIRT	56. Yes, Janice is wearing a shirt.
	57. Not a long dress today.
	58. It's too hot to wear a long dress.
42. TOO HOT	59. Maybe tomorrow.
43. TOMORROW SKIRT	
44. MAYBE SKIRT TOMORROW	60. Maybe.
45. /XXXXXX/	
	61. Yeah, Janice is washing dolly.
(Janice shakes head no)	62. Janice wash dolly's back?
	63. Not yet.
	64. What's Janice doing?
	65. Janice is washing dolly.
46. SUSAN	66. Yes, I'm here.
47. WHAT /XXXXXXX/	67. Ready to dry?
	68. Turn dolly over.
48. HI	69. Hi Janice.
49. NO PULL	70. No, don't pull dolly's hair.
50. LIKE (laughter and kisses dolly)	71. Janice likes dolly?

51. NO

52. NO WASH TABLE
53. NO

54. /SHHHHHH SHHHHHH/

55. YEA

56. NO

57. NO PINK DRESS

58. SUSAN

59. NO

60. DRY DOLL
61. DRY DOLL

62. UH

72. Janice is hugging dolly.
73. Dry dolly.

74. Janice, we're washing dolly.

75. Ready to dry? OK

76. What's Janice doing?
77. What's Janice doing?
78. Washing dolly?
79. Janice is standing dolly up.

80. Good girl, Janice is getting dolly clean.
81. Janice is washing dolly.
82. Washing dolly's body.
83. Ready to dry?

84. Janice is being a good girl today.

85. Janice is not wearing a pink dress today.

86. Susan is wearing a pink dress.
87. Janice, time to dry.
88. You have to wash dolly and brush her hair.
89. She's all clean.
90. Susan throw the rags in the basket.
91. Janice is drying dolly.
92. Turn dolly over?

93. Nope, not yet.
94. What's Janice doing?

95. Dry off?

96. Dry doll off.
97. Turn dolly over now?
98. Time to get her dressed.
99. Good, dolly is all dry.
100. Janice, Janice put the towel in the basket.

63. PUTTING PANTS ON

64. YEA

65. SHIRT

66. SHIRT

67. UH

68. SHIRT ON

69. YEA (laughter)

70. /XXXX/

71. /XXXX/

101. Ready to dress dolly?
102. Ready to dress dolly?
103. Good, put the towel in the basket, Janice.
104. Thank you.
105. What do you want?
106. What's Janice doing?
107. What's Janice doing?

108. Janice is putting the pants on.
109. Susan help?
110. Good, other foot.
111. Pull the pants up.
112. Janice is putting the pants on dolly.
113. Good girl, Janice put the pants on.

114. What do you want now?

115. Shirt? OK
116. Sit dolly up.
117. What's Janice doing?
118. What's Janice doing?

119. What's Janice doing?

120. Janice, what are you doing?

121. Shirt on, Janice is putting the shirt on.
122. Put the arms in.
123. Susan help?
124. Where's dolly's arm?
125. Where's dolly's arm?

126. Janice is putting the arm through the hole, good.

127. Good, Janice put the shirt on.
128. Ready for the shoes?

129. What's Janice doing?
130. What's Janice doing?
131. What's Janice doing?
132. Putting socks on?
133. Susan help.

72. TEA

73. SOCK ALL DONE

74. /XXXX/

75. PUT SHOE ON

76. /XXXX/

77. IN YARD?
78. YARD
79. OUT IN YARD?

80. COMB HAIR

81. NOT COMB

82. BRUSH

83. NOT COMB
84. COMB AWAY
85. COMB AWAY

86. SUSAN NO COMB
87. NO COMB FOR SUSAN
88. NO WHITE SKIRT

134. Janice is putting a sock on, good girl.

135. Another sock?
136. What do you want?

137. Janice is putting a sock on, good girl.
138. What do you want?

139. What do you want?

140. Put the shoes on.
141. Push, push, push Janice
142. Push the shoe on.
143. Janice put a shoe on.
144. One more?

145. Push, good girl.
146. OK, dolly is dressed.
147. Do you want to brush her hair a little bit?
148. Then it will be time to go.

149. Go back in the yard? Yes.
150. Almost time to go back in the yard.
151. What's Janice doing?

152. Combing the hair?

153. Not comb.

154. Janice is brushing the hair.

155. The comb's away.
156. Susan doesn't have a comb.

157. No white skirt.
158. No.

89. WHITE SKIRT
90. PURPLE

91. RED SHIRT
92. RED

93. PURPLE SHIRT

94. /XXX/

95. SHIRT UNDERPANTS

96. /XXXX/

97. IN THE YARD

159. Purple?
160. Does Janice have a purple skirt?
161. No.

162. Janice is wearing a red shirt, yes.

163. Janice is wearing a shirt, that's right.

164. Janice is wearing shirt.
165. Dolly is wearing a shirt.
166. Dolly is wearing a shirt.
167. Are you finished combing dolly's hair?
168. You're not combing, are you?
169. What's Janice doing?

170. Shirt and underpants.
171. Janice is wearing, dolly is wearing a shirt and underpants.
172. Ready to go Janice?
173. Time to go back in the yard?
174. Time to go back in the yard?

175. I can't hear you.
176. Sit up, what are you saying?

177. In the yard.
178. Time for Janice to to back in the yard.
179. Thank you for coming Janice.

TRANSCRIPT, Recorded
Chronologic: 12 yr 1 mo 21 da
Helene Wachs

(Clinician and Tyrome were discussing activity pictures in Tyrome's living unit.)

1. Tell me a story about the three pictures.
2. I know you can do it.
1. Can you tell me what it is?

1. BOY RIDING A BICYCLE

4. That's right.
5. That's a boy riding a bicycle.
6. Very good.
7. Can you tell me anything else about it?

2. NO

8. Nothing?
9. OK, let's try another one, OK?
10. Tyrome?

11. Look at these pictures and tell me a story about them.

3. YES

12. The duck's in the water.

4. DUCK IN THE WATER

13. Can you tell me anything else?

5. DUCK IN THE WATER

14. The duck's in the water.

6. DUCK IN THE WATER

15. OK, that's very good.
16. Do you like it here?

7. YES

17. Why not?

8. NO

18. What?

9. PEOPLE

19. There's different people here.

10. THE PEOPLE

20. When did you come here?

11. THE WEEK

21. When did you come here?

12. THE WEEK

22. You came the beginning of the week?

13. YES

23. And you don't like it?

TRANSCRIPT, Recorded

14. NO I HATE IT

24. You hate it?

15. YES

25. I'm sure you'll get used to it.
26. It's a very nice place.
27. Do you wanna tell me another story?

16. NO

28. Can you tell me something about these three pictures?

17. NO
18. I CAN'T DO IT

29. You can't do it?

19. NO

10. Oh yes you can do it.
11. Let's go.

20. WHAT'S THAT?

32. You tell me what that is.

21. SQUIRREL

31. That's a squirrel
14. Tell me a story about the squirrel.

22. SQUIRREL EAT

35. The squirrel's eating?
36. What's that?
37. Tell me a story about it.

23. SQUIRREL EAT

38. The squirrel is eating.
19. Can you tell me some more?

24. SQUIRREL EAT

40. The squirrel is eating.
41. That's very good Tyrome.
42. Oh boy what's that outside?

25. RAIN

43. Rain yes it sure is.
44. Do you like the rain?

26. NO
27. YES

45. Yeah.

28. WHAT ABOUT YOU?

46. What about me?

29. YEAH

47. Sometimes but not all the time.

30. WHY?

48. Why?

31. GOOD

32. YES

33. YEAH
34. OK

35. I WANNA GO

36. I'M NOT

37. A FEET

38. A SHOE

39. FEET SHOES SOCK

40. THE SHOE AND SOCK

41. BIRD BIRD

42. BIRD NEST

49. Cause it gets me wet and when it gets me too wet I don't like it.

50. That's good?

51. You like to get wet huh?

52. OK ready for another story?

53. I'm ready for another story.

54. You're not?
55. Well get ready.
56. What do you see here?
57. Tell me a story Tyrome.

58. Yeah what about the feet?

59. Tell me a story about it.
60. You can do it.

61. Yeah that's right.
62. There's feet, shoes and socks there.
63. Now tell me a story.
64. Put it all together.

65. Um hum and where are they putting the shoe and the sock?
66. That wasn't a very good story.
67. Can you tell me a better story next time?
68. Tyrome?
69. Can you tell me a story about this Tyrome?
70. Huh.
71. Come on, stand up tall and listen.
72. Tell me a story about what you see here.

73. Can you tell me a story about that?

74. The bird in the nest.

43. HE EAT
44. ATE IT

45. YES

46. CAUSE

47. CAUSE

48. CAUSE /DOES IT/

49. WHAT THAT

50. THE BIRD ATE HIS NEST
51. HE ATE IT

52. BECAUSE

53. TASTE GOOD

54. YEAH

55. FINGER

56. A HAND

57. A--
58. A--
59. RING, RING

60. TWO RING

61. ONE HAND

75. That's right.
76. What about the bird in the nest?

77. He ate it?

78. Why did he do that?

79. Cause what?

80. You're being silly.

81. Cause what?

82. Tell me a story about that.
83. You told me that the bird ate his nest.

84. Why did he eat it?

85. Because what?
86. You gotta give me a good answer now.

87. It tastes good?

88. OK. OK that's a good answer.
89. OK Tyrome another story about what you see here.

90. What?

91. Yeah what about the hand/

92. Yeah a hand and a ring.
93. What happened?
94. Tell me a story.
95. You can do it.

96. Two rings, yeah.

97. And one plain hand.
98. That's right.

62. A FINGLR

63. WHAT

64. FINGER

65. RING

66. YEAH

67. CANDLE

68. CANDLE CANDLE CANDLE

69. FOUR CANDLE

70. FOUR

71. YES

72. ONE TWO FOUR

73. FOUR

74. /XXXX/

99. Can you tell me a story about something?

100. What?

101. Hey come on now, tell me a story and don't be silly.
102. You can do it.

103. Yeah finger, what about it?

104. The ring's on the finger.

105. OK here's one more story for you.
106. Can you tell me what's happening?
107. Tell me a story.

108. Candle yeah.

109. How many do you see?

110. How many?

111. Are you sure?

112. Count them for me.

113. One two four, what happened to three?
114. How many candles are there?

115. OK tell me a story about them.

(Clinician and Tyrome were conversing informally and discussing activity pictures in Tyrome's living unit.)

1. GOOD

2. HOW A YOU?

3. NO

4. AWFUL

5. /EEEE/

6. /EEEE/

7. OK
8. YEAH

9. YEAH

10. BOY WEAR BOOT

11. YEAH

12. BOY WEAR BOOT

13. NO

14. BOY COAT

15. YEAH
16. BOY WEAR BOOT

1. OK Tyrome how are you today?

2. Good?

3. I'm fine.
4. Did you have a nice day yesterday?

5. Why?

6. Why was it awful?

7. Why was it awful?

8. OK ready to work?

9. OK let's get ready to work.
10. I've got some pictures here.
11. Can you see those pictures?

12. Tell me about those pictures.

13. The boy is wearing boots?

14. Can you tell me some more?

15. Sit up tall.
16. Let's get ready to work.
17. What can you tell me about these pictures?
18. Can you make up a story?

19. Yes you can.
20 Come on.

21. Boy is wearing a coat also.

22. And the boy is wearing boots

17. YEAH

18. YEAH

19. NO

20. YES

21. WHAT THAT?

22. WHAT THAT?

23. NO

24. SNOW

25. NO

26. I CAN'T

27. NO I CAN'T
28. BOY ON SLED

29. GO WAY UP BOOT /XXXX/
30. OK?

31. BOY RIDING SLED

23. Very good.
24. Can you tell me some more?
25. Tell me some more.
26. Boy is wearing boot.

27. Good, anything else?

28. You sure?
29. OK Tyrome.
30. That was very good.
31. Would you like to look at some more?

32. OK tell me a story.

33. What?

34. Do you know what that is?

35. That's a sled.
36. Do you know what's all around it?

37. That's right, snow.
38. Can you tell me a story about that?

39. Can you try?
40. OK try.

41. Yes you can.

42. Boy on the sled good.
43. Tell me a story about this.
44. Sit up tall and get ready to work.
45. Tell me a story.

46. No, leave the tape recorder on and tell me a story about the boy here.

47. Boy riding sled?
48. Good.

32. BOY WEAR BOOT

33. OK?

34. OK

35. DOCTOR

36. DOCTOR

37. STAY GIRL

38. YEAH

39. GO SLEEP

40. I SAY GO SLEEP

41. YES

42. THEY GO
43. THEY GO AWAY
44. GO PLAY

45. YEAH

46. OK?

47. NO

48. THAT'S ALL

49. GOOD

49. Good.

50. OK what?
51. OK what?

52. Let's see what we have here.
53. Alright, look at these pictures and tell me a story.

54. Yeah.

55. Doctor, what's the doctor doing?

56. Doctor and the girl.

57. What's the girl doing?

58. What?
59. What's the girl doing?
60. Say it again.

61. Go to sleep.
62. That's very good.

63. Is that the story you want to tell me?

64. She's going away to play.

65. Oh, that's a good story.

66. Good story Tyrome.
67. Do you have anything else you want to tell me?

68. That's all?

69. No not now Tyrome.
70. Later you'll do it.
71. How are you?

72. I'm glad to hear that.
73. Yesterday you weren't so good.

50. BOY RIDING A BIKE
51. BOY RIDING A BIKE
52. HE FALL
53. HE GET UP
54. THE BOY THE BUMP
55. FALL
56. BOO-BOO BOO-BOO

57. WHAT DO YOU DO?
58. WHAT YOU DO BOO-BOO?

59. YES

60. DOCTOR
61. DOCTOR

62. MAKES IT ALL BETTER

63. YES

64. ALL OVER?

65. THIS BOY RIDING A BIKE

66. THIS BOY FALL A BUMP

67. HE FALL
68. HE FALL BOO-BOO

69. DOCTOR
70. DOCTOR WASH

71. WASH

72. YEAH

74. OK Tyrome.
75. There's a few more pictures.
76. Look at these pictures and tell me a story.

77. That's right.
78. He has a boo-boo.

79. What do you do for the boo-boo?

80. I'll show you in a minute.
81. Look what happens now.
82. What happens?

83. Yeah, what does the doctor do?

84. Makes it all better?

85. Now tell me the whole story all over again, OK?

86. All over the beginning.

87. Yeah and then what happens?

88. He falls over a bump

89. And then he gets a boo-boo

90. What does the doctor do?

91. Washes it?

92. Very good.
93. And then what happens?

73. ALL BETTER

94. He's all better.
95. That was a very good story Tyrome.

74. OK?

96. Nope not yet.
97. We've got a few more things to look at.
98. Here Tyrome, look at these pictures and tell me a story.

75. THIS GIRL BUBBLE

99. Yeah bubble bath?

76. THIS GIRL BUBBLE BATH

100. A girl is in the bubble bath.

77. THIS GIRL GO SLEEP

101. What go to sleep?

78. YEAH

102. OK that's right.
103. What else can you tell me?

79. This girl

104. What's that called?

80. TEETH
81. BRUSH HER TEETH

105. Brush teeth.
106. That's right Tyrome.
107. That's a very good story.
108. Can you tell it to me again?

82. NO

109. Please?

83. ALRIGHT

110. One more time.

84. THIS GIRL GO TO SLEEP
85. THIS GIRL GO WASH
86. THIS GIRL
87. THIS GIRL BRUSH HER TEETH

110. Brushing teeth.
111. That's right.
112. How about this one?
113. Can you tell me a story?

88. OK

114. OK come on.
115. Sit up tall.
116. Sit up tall Tyrome.
117. Look at the pictures and tell me a story.

89. THIS GIRL GO SLEEP

118. Yes.

90. THIS GIRL GET DRESSES

119. That's right.
120. That girl is getting dressed.

91. OK?

121. Can you tell me a whole story now?

92. NO

122. Come on.
123. You can do it Tyrome.
124. Come on.

93. THIS GIRL GO SLEEP
94. OK

125. Very good OK.
126. Alright, time for another story again.
127. Let's tell another story.

95. BUS

128. Bus, that's right.
129. Tell me a story.

96. MAN DRIVE A BUS

130. Man drives a bus.

97. GO GO SCHOOL

131. Going to school.
132. That's right.

98. THIS GIRL WRITE

133. The girl is writing.
134. Very good.
135. That's a beautiful story.

99. OK?
100. OK?
101. TAPE?
102. OK?

136. It's not time to turn it off.
137. Not yet Tyrome.
138. OK let's look at these pictures Tyrome.

103. GIRL COOK

139. The girl is cooking.

104. YEAH
105. THEY EAT

140. They're eating.

106. YEAH

141. Right and what else?

107. THEY GO WASH THE HANDS DISHES

142. The dishes?

108. YEAH

143. She's washing the dishes, that's right.
144. Tell me that story again.

109. THIS GIRL COOK
110. THIS GIRL EAT
111. THIS GIRL EAT
112. THEN THEY WASH HAND DISHES

145. Good boy Tyrome.
146. Very good.
147. And do you know what you can do now?

113. I KNOW (Laughter)

APPENDIX D

TRANSCRIPT, Written
Chronologic 15 yr

John
1973 Sample -1

(Spelling and Capitalization are preserved from orfginal)

January 1973

2 John take a Bath
2 pll (paint) tall Down
2 (The teacher jump over the water.)
2 (The spaceman gives the book to John.)
2 John teur (draw) the Batman
2 Woman read the paper and has a Dog
3 Tracher (teacher) Jumping (jump) sevo (over) the Fence
3 Dog brink (drink) the 7 up
3 (John makes the pancake.)
3 Lady sit Down
3 (The dragon look under the car.)
3 Superman stial (wash) the sutaisre (dishes)
4 Batman talk on the Telephone
4 Alrplan (airplane) on the Box
4 (Three men ride in the racket.)
4 Tan prian (wash) the Car
4 (John put on the shirt.)
4 Trazun (tarzan) run has a Monkey
8 John has a sanke (snake) and tarzan has a Sanke (snake)
8 (Jim gives the pencil to the teacher.)
8 Superman pencil (paint) the feene (fence)
8 Rabbit in the Water
8 (John wash the dishes.)
8 Spaceman witrh (write) the Rocket
10 John rido (ride) the Car
10 Man Drink (drink) the 7 up
10 (Tarzan throw the knife)
10 Snake get out the Doghouse
10 Jim read the Book
10 (The octopus fall out of the water.)
11 Dog drink the Pump
11 (John give the ball to Sandy.)
11 Sandy run klck the Helicopter
12 Tarzan ride the Motorcycle
12 Tracher (teacher) oas (draw) the Paper
12 (John plays with the toy train.)
12 Lade give (gives) the ball to John
12 Trazan (tarzan) look under to the Water
12 (Jim makes the cake.)
15 (A tree on the truck go to house.)

TRANSCRIPT, Written

John
1973 Sample -2

January 1973

15 Sandy and John wtchle (watch) the Color TV
15 David pet (pat) the boot On
15 Lady rodl (ride) the motor cycle fall down the Water
15 Monkey has a Tarzan has a klnfe (knife)
15 (Sandy drinks the milk.)
16 Batman give (gives) the to Batman
16 Jim Jump over the fire
16 (The old man sit down on the chair.)
16 Trina (train) and Drive-In
16 Man get out the Church
16 (John and the teacher look at the movie.)
17 John down Step
17 Batman talk the Telephone
17 (David and Sandy watch the color TV.)
17 Girl emke (make) the Cake
17 tze (seal)
17 (The girl looks under the bell for the cup.)
18 John gives and soct (sock) to Man
18. Batman run klck the Cow
18 (The lady drives the bus.)
18 Sukae riro (climb) up the Steps
18 Gire (girl) make the Cake
18 (Tarzan cuts the monkey with his knife.)
22 Superman run throw the Shoe
22 (John klck the box under the table.)
22 Woman has a glass the Jim
22 Grll (girl) fall down the Water
22 Dog eat the Tiger
22 (The old man drives the tractor.)
23 tarzan pelt (climb) up the Steps
23 (The Indian jumps over the boat.)
23 Lady glues (gives) the candy (candle) to Man
23 Snady (sandy) takes a Bath
23 Lady pet (cuts) the pizza and knife
24 (John puts the boot on.
24 (Woman and lady sit down on chairs.)
24 Lady Lay down go to Sleep
24 John blow the Hour (horn)
24 Off (old) man tchae (iron) the Shira (shirt)
24 Batman put the boot on and Boot
24 (John washes the dog under the pump.)

January 1974

26 Dragon dunk (drink) the Water
26 Woman look under the Table
26 (The cat is in the box.)
26 Tarecher (teacher) witr (write) the Paper
26 indian ron Jump over the fence
26 (The spaceman makes a rocket.)
29 Tancher (teacher) gives the to John and Paper
29 Woman throw the Pan
29 (The lion and the tiger to to the boat.)
29 Lady bnep (climb) op the Helicopter
29 (Batman kicks the monkey's hand.)
29 Man has a gnu
30 Tarzan has a memmg (garbage) Can
30 Man cop (out) the nino (chain) and Saw
30 (The mother has a baby.)
30 Supermm and Lady
30 (The spaceman puts the rock in the box.)
30 Tancher (teacher) rido (ride) the Motor cycle
31 Rabbti (rabbit) and pig and horse go to Boat
31 (Spaceman throws hammer at the box.)
31 Man sleep the Water
31 Spider go to School
31 Jim make the Cake
31 (Oh boy! John eats six hamburgers!)

February 1973

1 Bird go to birdhouse
1 Bell and book and candle on the Table
1 (John takes a bath with the duck.)
1 (Sandy look under the bed for the shoe.)
1 Lily (lady) kick the Ball
1 Tarcher (teacher) ride the motor Cycle
2 Lady ride the Bicycle
2 (Supermm runs to the church.)
2 Monkey jump over the Banana
2 Tracher (teacher) take (talk) the Telephone
2 (John pumps the wter out.)
2 Tarzan throw the knife and Monkey
5 Tarzan throw the Hammer
5 (John drink the orange juice.)

February 1973

5 Woman sirv ("/grass/") the Bed
5 Jim look under the bed and pants look under the Bed
5 Man ride the train
5 Dog fall down the Water
6 (Batman look under the stove.)
6 Jim takes the shirt On
6 Tarzan mjdrh (climb) op the Tree
6 Taercher (teacher) has a read the Book
6 Woman get the Fish
6 (John and the girl watch the movie.)
7 Woman make the Cake
7 Teacher blow the Honr (horn)
7 (Tarzan climb up the tree.)
7 Man witr (write) the Paper
7 (Jim runs and kicks the flower.)
7 John get the Ball
8 Tiger to to Barn
8 Teacher witer (write) the paper and john witer (write) the Paper
8 (John blow out the candle.)
8 Dragon get the Elepaht (elephant)
8 Nommy midar (climb) op the Steps
8 (Superman throw the ball to the spaceman.)
9 Man wsah (wash) the haen (hair) and Pump
9 Teacher gives the to lady and Paper
9 (The tiger jumps on the cow.)
9 Tarzan ride the elephat (elephant) has a Forg (frog)
9 (Mommy runs to the car.)
9 Lady write the Book
12 (The woman jumps over the spider.)
12 Elephant go down the Steps
12 Man take the shiar (shirt) On
12 Nommy has a ouarhe (orange) duler (joice) on the Table
12 (Two cups of coffee fall off the table.)
12 Break the motor Cycle
13 (John takes off the pants to make a bath.)
13 Tarzan has a tish the Water
13 Woman tale (talk) the Telephone
13 Woman Sirv (----)
13 (Mommy and Sam and John eat dinner.)
13 Taerher (teacher) wash the Beteplay (dishes)
14 Woman write the Paper

February 1973

(Jim rides in the boat.)

Batman run the Hand
Snake get out the Camper
Lady cup (cut) the orange and Knife
(Teacher takes a bath.)

Woman sit Down
Dragon dinle (grab) the Sapceman (spaceman)
(The shirt is on the bed and the shoe is under it.)

Lion has a Tiger
(Sam rides in the boat.)
Lady cot (out) the water sowor (melon) and Knife
Lady lay Down
Superman fall Down
(Two men wash the car.)
(Sandy gets out of the car.)
Tarzan run dringp (climb) up the steps and lion run dringp (climb) up the Steps
Lady cut the con (corn) and Knife
(John throws the knife at the pumpkin.)

Tearher (teacher) ride the motor Cycle
Snady (snake) and pig and cow and lion go to the Boat
Dragon get the Spaceman
(Tarzan blows the horn.)

Oldman (old man) has a Dog
Man wash the Car
Clock on the chair and hat on the Couch
(John puts a wrench in the tool box.)

Two bird eat the Bread
(Teacher writes on the paper.)

Lady cut the cake and Knife
Woman teka (talk) the Telephone
(The man cuts the cake.)

Teacher put the coat On
Indian fall down the Fence
Tools Box
(The seal sees the fish under the water.)

Two man ride the Boat
(John lays down on the couch.)

Woman get out the Car
Snake drink (drink) the Coke
Monkey has a Tarzan

February 1973

(Tarzan sleep in the tree.)
(The Batman kicks the teacher.)

Dog eat the Chiclie (chicken)
Elephant sit down break the Couch
Suparman (superman) two has a dragon
(John writes on the paper.)

Man give the key to Lady
(The man listens to the radio.)

Dragon eat the fire
Mommy swah (wash) the Horse
Two batman play witrl (with) Ball
Color Tv
(Mommy climbs up the steps.)

Teacher has a Redio (radio)
Cen (clown) kick the Mevosla (bucket)
(The elephant puts the tree on the truck.)

Spider look under the Boot
(Mommy makes the coffee on the stove.)

Tarzan throw the knife and Lino (lion)

March 1973

Lrae (seal) fall of the staps (steps) the Water
Two crat (clown) throw the cake break the Hat
(John subtracts the numbers.)

Tarzan on the Elephant
Two monkey put (climb) up the Tree
(Teacher reads the book.)

Clow (clown) has a throw the Clow (clown)
(Mommy and Sandy wash the dishes.)

Lady read the book sleep the Couch
Bat has a teacher
Woman has a Tarzan
(John adds the numbers.)

Two cat take a Bath
(The lady runs to the car.)

Teacher write the paper and john write the Paper
Clown has a mdbedthe (umbrella) and has a Cat
(The lady runs from the car.)

Man blow the Horn
Teacher play good Ster (tar)
(The dragon gets the spaceman.)

March 1973

6 Tarzan has a Woman
6 Tarzan has a tarzan fall Down
6 Man eat Hamburger
6 (The woman runs from the spider.)
7 Man ran the Church
7 Man ran out the Church
7 (John puts the pants on.)
7 Snail and seml (nail) and snail and Seml (nail)
7 Lamp fall down the Stepa (steps)
7 (Hey diddle diddle, the cat and the fiddle, the cow jomped over the moon.)
8 Snail drink the Coke
8 (The monkey climbs up the tree.)
8 Dragon put (grab) the Camper
8 Elephant eat the Pednul (peanut)
8 (Mommy steps on the spider.)
8 Clown
9 Batman ran
9 (The Lady comes from the store.)
9 Two clown redi (ride) the Elephant
9 John add the Sontap (numbers)
9 Couch fall down the Airplaret (airplane)
9 (Sandy blow out the candle.)
12 Clown siv (catch) the Clown
12 Woman come here the Man
12 (Batman throws the ball to Tarzan.)
12 John fall off the Bed
12 Monkey eat
12 (Teacher and Sandy paint the fence.)
13 Two snake get out the bird House
13 Lady run kick the Telephone
13 (The Camper go to the drive-in.)
13 John redi (ride) the Bicycle
13 (Batman fall in the water.)
13 John has a flower and has a Fish
14 Woman lay down the Couch
14 (Two men wash the car.)
14 Tarzan dimul (climb) up the Tree
14 (Mommy steps on the spider.)
14 Teacher redl (ride) the motor Cycle
14 Lady give the radol (radio) to John
15 Tarzan has a hammer and has a two Wrench
15 (Two monkeys get in the camper.)

March 1973

15 Teacher ride the motor Cycle
15 Mommy made the coffee the Stove
15 (Three clows fall down.)
15 Sandy get out the Car
16 Two clown throw the Pan
16 (Lady comes out of the church.)
16 Lady dimrl (climb) up the Cirn (chain)
16 (John eats the peanuts.)
16 Tarzan ride the elephant has a Knife
16 Jim wash the Dog
19 Batman sleep the Water
19 (The elephant is on the train.)
19 Woman Run
19 (The man rides in the car.)
19 Lady has a two Snake
19 John take a Tbah (bath)
20 (John and Sandy eat the cake on the table.)
20 Woman drink the Pump
20 Tarzan run the steps throw the fork
21 Lady cup (eat) the cake and Knife
21 Baby blow out the Candle
21 (Tarzan swims in the water.)
21 Horse kick the Clown
21 (John looks under his bed for the shoe.)
21 Jim add the Tallrel (number)
22 Dog on the Ball
22 Sandy eut the pazzi (pizza) and Knife
22 (The teacher rides the bicycle to school.)
22 Seal sleep the Water
22 (Mommy makes the hamburgers.)
22 Woman fall ride the Elephant
23 Elephant get out the two train
23 Sandy come wirte (with) me the Man
23 (Teacher eat the hamburger.)
23 Two clown sten (shott) the Hour (horn)
23 (I put six balls on the table.)
23 John paint the Paper
26 (John and Jim subtract the numbers.)
26 Tarzan run on the Train
26 Woman run and teacher too fall off the Water
26 (The spaceman paints the rocket.)

March 1973

26 Jim run kick the Bicycle
26 Elephant and clown Run
27 Man has a chria (chair) and Lion
27 (The teacher rides a motorcycle.)
27 Woman sit down the Couch
27 (Batman throws the knife at the dragon.)
27 Woman get out the Stras (store)
27 Man has a Horse
28 Cat come here and Lady
28 Sandy cut the banana and Knife
28 (Tarzan dig up the tree.)
28 Clown fall off the Bicycle
28 (Six elephants ride the train.)
28 Woman paint the House
30 Clown play Ball
30 (John and the teacher get on the school bus.)
30 Woman sit down the Swing
30 Two woman ride the Horse
30 Tarzan has a hotdog and has a icecream
30 (Mommy comes to school to get John.)

April 1973

2 (John and Kerry ride in the bus back to school.)
2 Lady down (fall) off the airplare (airplane) and man down (fall) Off the Swing
2 Man jimping (jumping) and sepp (mouse) get out the Truck
2 Clown blow the Horn
2 Teacher lay Down
2 (Man rides the horse.)
3 Woman fall off the Swing
3 Man ride the Motorcycle
3 (John tells Sam about the circus.)
3 Tiger jump on the fire
3 (Teacher digs up the flower.)
3 Man fall off the Horse
4 Indian run the Water
4 John eat the Pie
4 (Screw and nail and hammer and wrench)
4 Lady ride the Car
4 Jim steps the Spider

April 1973

4 (The woman fall out of the swing.)
5 Batman gives the pie to Mommy
5 Woman get out the Elephant
5 (Donald Duck wash his hands with the soap.)
5 Fire on the House
5 (The dragon gets the teacher.)
5 Car go to Truck
9 (Superman climbs up the steps.)
9 Tarzan has a Monkorcan (garbage can)
9 Woman run fall the Water
9 (John makes his bed.)
9 Woman has a Gun
9 Man eat the Carnpop (popcorn)
10 Lady bns (push) the Batow (button)
10 (Mommy makes the pancakes for Sam.)
10 Troomen (policeman) Run
10 Women cole (hurt) the ona (arm)
10 (John jumps over the fire.)
10 Batman bimlo (climb) up the Tree
11 Monkey umi (fly) the Kite
11 (The lady cuts the pumpkin in two.)
11 Tarzan rodowe (open) the Door
11 Woman sit Down
11 Sam redl (ride) the Car
11 (Teacher swims in the water.)
12 Mommy bimck (climb) up the Steps
12 (Teacher opens the door.)
12 Women pael (hurt) the Ray (arm)
12 Woman gives the dollar to John
12 Sam redi (ride) the Car
12 Clown tly (fly) the Kite
13 Tarzan muose (hurt) the Aer (arm)
13 Woman copn (open) the Door
13 (Hickory, dickory, dock, the mouse ran up the clock.)
13 (Sandy runs to fly the kite.)
13 Lady jump rove (over) the Tiger
13 Sam and john redi (ride) the Car
23 Elephant has a flower
23 Lady add the Flaschl (numbers)
23 (Batman swim in the water.)
23 (Sam ride in the car.)
23 Dog fel (fly) the Ketl (kite)
23 Mommy lonn (iron) the Shirt

April 1973

24 Batman bimlo (climb) up the Tree
24 (Sandy watch the clown on TV.)
24 Sam ride the Truck
24 Man look under the Couch (couch)
24 Lady onpe (open) the Door
24 (Hey diddle diddle,
the cat and the fiddle,
the cow jumped over the moon.)

25 Woman has a Paint
25 Tarzan ride the Dog
25 (The teacher wash his car.)
25 (John has a dollar.)
25 Woman cut the Dragon and Knife
25 Jim stops the Spider
26 (Sam ride in the car.)
26 Woman yet out the Train
26 Two Tarzan lay down the Water
26 (Hickory dickory dock,
The mouse ran up the clock.)
26 Tearher (teacher) has a Crayon
26 Lady made the Cake
27 (The boy hurts his foot.)
27 Sam open the Truck
27 Jim gives the dollar to Lady
27 Two man break the ride the Car
27 (Mary had a little lamb,
It's fleece was as white as snow.)
27 Lady had a Bertbail ("/lebring/")
30 Dam inor (iron) the Shrit (shirt)
30 (Sandy and John cook the hot dogs on
the fire.)
30 Tarzan run go to School
30 Lady throw the Knife at the Tree
30 (John throw the ball at the tree.)
30 Dragon get the spaceman Kun

May 1973

1 Spaceman run go to Rocket
1 John lay down the Bed
1 (Sam steps on the snake.)
1 (The Batman throws the shoe at the
dog.)

May 1973

1 Woman talk the Telephone
1 Tarzan kick the Dragon
3 (John comes out of the tent.)
3 Lady get out the Spider
3 Sam rite (ride) the Car
3 Man has a Eiyhtfirvo (slippers)
3 Dog Sleep
3 (Mary had a little lamb,
it's fleece was as white as snow.)
4 Two seal go to Boat
4 (The teacher falls off the chair.)
4 Sandy paint the House
4 John sleep on the Bed
4 (And everywhere that Mary went,
The lamb was sure to go.)
4 Lady cut the Pizza
7 Lady neop (open) the Door
7 Man take a Bhat (bath)
7 (Superman and Batman play with the
ball.)
7 Tarzan has a man fall down the Water
7 Monkey on the table and john has a fish
7 (Sam and John ride in the car.)
8 Spider on the Lady
8 (Mommy iron the shirt.)
8 Man gives the down (dollar) to Indian
8 Sam wash the Car
8 Man Dig
8 (Teacher opens the door for the lady.)
9 Jim fly the Kite
9 Man hwolt (hurt) the Ram (arm)
9 (Teacher jump over the water.)
9 (Sam rides the motorcycle.)
9 Sandy take a Bath
9 Odlman (old man) has a Dog
10 Man cut the banana and Knife
10 Man come here the lady open the Door
10 (John takes a bath.)
10 Teacher fly the Kite
10 (The old man gives John two dollars.)
10 Lady ride the Bicycle
14 Man ride the Camper
14 (Teacher runs to fly the kite.)
14 Woman hwll (hurt) the Hand

May 1973

14 (John and Sandy wash the car.)
14 Tarzan bimal (climb) up the Tree
14 Woman put (???) the Dragon and has a knife
15 Sandy and john and teacher wash the Car
15 Batman open the Door
15 (Mommy gives John two dollars.)
15 Man cut the cheese and Knife
15 Lady sleep wieat (watch) the Tv
15 (Two indians jump over the water.)
16 (The dog hurts his foot.)
16 Mommy make the Pancake
16 Snake drink the Coke
16 Teacher wash the Dog
16 Woman Swing
16 (Tarzan opens the door.)
17 (Sam eats the pancakes on the table.)
17 Lady drink the Nike (milk)
17 Tarzan has a Tree
17 Rabber (rabbit) has a Iegne (fence)
17 Woman fly the Kite
17 (The cat sleeps on the couch.)
18 Sam sleep under the Tent
18 Lady jump over the Dragon
18 Break the Motorcycle
18 (Jim and John add the numbers.)
18 Lady look under the Couch
18 (The teacher cooks the hamburgers.)
21 (Jack and Jill
Went up the hill)

21 Dragon mdiat (grab) the Spaceman
21 Lady weieat (watch) the Color tv
21 Sam has a Pamp (pump)
21 John ride the Horse
21 (Mommy washes the shirt.)
22 Batman kick the Pump
22 Woman ride the Tractor
22 (Sandy cuts the flowers.)
22 John blow the Candle
22 John fly the Kite
22 (The elephant eats the peanut.)
24 Woman run to the Steps
24 (Jim has tone dollars.)
24 Pan and knife and Irok (fork) and Spoon
24 Tarzan hurt the leg

May 1973

24 Lady jump over the Snake
24 (John fly the kite in to the tree.)
31 (John puts the pants on.)
31 Sam watel (watch) the color Tv
31 Teacher rido (ride) the house (horse) and woman go to house (horse)
31 Lion jump over the Tarzan
31 Woman open the stove
31 (The man cuts the hair off the sheep.)

September 1973

5 Lion shir (grab) the Tarzan
5 Woman open the Stevo (stove)
5 (John comes to school on the school bus.)
5 (John puts on the pants.)
5 Sam and mommy wahet (watch) the color Tv
5 Tearhor (teacher) and lady rode (ride) the Hoouse (horse)
6 Dragon eat the tree
6 (John comes on the school bus to school.)
6 Man drink the Coke
6 Two rocket go to Sun
6 Baby blow the Horn
6 (Sandy gets in the camper.)
7 Tarzan dimle (climb) up the Tree
7 Dog house sleep
7 (The teacher falls down on the bed.)
7 Sandy look under the Canck (couch)
7 (Sam rides in the truck.)
7 Superman read the Book
10 John witer (write) the Paper
10 (Superman jumps over the school.)
10 Sam oase (rura) the jumj (pump) on
10 John lay down the Cauanah (couch)
10 Jim fly the Kite
10 (The tiger jumps over the fire.)
11 Monkey has a Sauke (snake)
11 Dragon mileb (grab) the Spaceman
11 (David sleeps in his bed.)
11 (The two boys come to the house.)
11 Baby come to the horse the Sandy
11 Break the Apleitar (airplane)

September 1973

12 Lady throw the Ball
12 (Batman falls down into the water.)
12 Camper go to Drive-in
12 Tarzan slimb (climb) np the Elephant
12 John harel (put) the two Cook (boot) On
12 (The lady makes the pancakes.)
13 Monkey throw the Banana
13 Cow and pig and horse go to Boat
13 (Teacher wash his car.)
13 Batman wtier (write) the Paper
13 (John puts on his coat and hat.)
13 Woman make the Cake
14 Teacher ride the Motorcycli (motorcycle)
14 Lady take a Bath
14 (The man lay down in the car.)
14 Snake get out the Box
14 Man has a Toy
14 (Mommy look under the couch for the jar.)
17 Batman cup (cut) the pump (pumpkin) and Knife
17 John and teacher wash the Car
17 (The spaceman gets a dollar from the box.)
17 (Mommy works at the store.)
17 Sam ride the Truck
17 Lady and jim on the Cuauauk (couch)
18 Lady ride the Rocket
18 Sapceman (spaceman) get a dollea (dollar) from the Box
18 (The boy drinks the water from the pump.)
18 Tarzan ride the Lino (lion) has a Knife
18 (The woman takes a bath.)
18 Batman gil (dig)
19 Cat on the Car
19 (Mommy and Sam sleep in the bed.)
19 Woman Kick the Teacher
19 Tarzan gives the ice cream to Tarzan
19 Lady hiul (turn) on the Leup (lamp)
19 (Look! The elephant falls down!)
20 Lady tunh (turn) on the Light
20 Tiger run to the Water
20 (The man comes to the store.)
20 (The rabbit sits in the box.)
20 John look under the Pump

September 1973

20 Sandy Dig
24 (John goes to the bathroom.)
24 Dragon get the ball and sam throw the Hat
24 Nan witer (write) the Paper
24 Sapceman (spaceman) get the capp (file) fome (from) the Box
24 Mommy and dog take a Bath
24 (Seven birds eat the corn.)
25 (John sits down in the chair.)
25 Teacher get the wrench frmo (from) the leer (tool) Box
25 Sam ride the Car
25 Lady get out the Stoes (store)
25 (John throws the ball to Jim.)
25 Lady trun (turn) on the Light
26 Mommy iron the Pants
26 (John turns on the light.)
26 Lady dup (cut) the butter and Knife
26 Monkey has a lady and has a Tree
26 (John go to the bathroom.)
26 Camper go to Church
27 (Teacher takes a hammer from the box.)
27 Lino (lion) nino (yawn)
27 Sandy read the Book
27 Lady hrut (turn) on the Light
27 Man has a ice trof (tray)
27 (John works in the store.)
28 Man hiut (hurt) the Hasd (hand)
28 Monkey trun (turn) on the light
28 (Sandy and John and Mommy and Sam and David and Peggy.)
28 Lady kick the Woman
28 (Spaceman and Batman and Tarzan and Superman.)
28 Sam Run

October 1973

1 (Tarzan falls out of the tree.)
1 John hrut (hurt) the Hant (hand)
1 Lady take a Bath
1 Lady cup (cut) the pie and Knife
1 (The boy blows out the candle.)
1 Lady trun (turn) on the Light
2 (The bus comes to school.)

October 1973

2 Tiger and elephanet (elephant) fall Down
2 Woman run throw the Ball
2 (Thirteen cups are on the table.)
2 Bird house on the Tree
2 John tale (talk) on the Telephone)
3 (Sam takes a bath in the camper.)
3 Teacher cut the Stalhig (numbers)
3 Jim throw the ball the Dragon
3 Rabby fall down the feene (fence)
3 Elephant get on the Train
3 (Mommy and Sandy drink the cokes.)
4 Lady trun (turn) on the Light
4 (The teacher writes on the paper.)
4 Man trun (turn) on the radio and talI (talk) the Telephone
4 Batman rodi (ride) the Bicycle
4 Eet (mickey) the rleai (mouse) eut the pumpkin and Knife
4 (Tarzan pumps the water.)
5 Two loin (lion) go to Airphant (airplane)
5 (Superman kicks the football.)
5 John sleep under the Bed
5 Tarzan go to Stap (steps)
5 Man look under the Camper
5 (John cuts the boxes in the store.)
8 Tarzan throw the hammer and has a Tree
8 (Batman washes his foot.)
8 Mommy tory (cook) the Egg
8 four snake go to Airphant (airplane)
8 Sam has a Pump
8 (The woman kicks the dragon.)
9 (Mommy and Sam cut the flowers.)
9 Superman has a Box
9 Tool Box
9 Lady cook the Hamburget (hamburger)
9 (John makes his bed.)
9 Cat fall down the Table
10 Teacher throw the watch and ride the Helicopter
10 (Mommy and Sam sleep in the bed.)
10 Cat get out the Tent
10 Bird eat the ice cream
10 Lady trun (turn) on the Light
10 (Sam cut the pizza and knife.)
11 (Lady put on the shirt.)
11 fish drink the Coke
11 Man print (paint) the Airphant (airplane)

October 1973

11 Batman catr (catch) the Ball
11 Dragon turn on the Light
11 (Six wrenches are in the tool box.)
12 Lady throw the Jar
12 (Sam cook the hamburgers over the fire.)
12 Monkey himck (climb) up the Bam (chain)
12 Lion stars (steps) the Snaky (spider)
12 Sandy prtrt (paint) the Bird
12 (The lady turn off the light.)
15 Dragon bIlmo (grab) the Sapeeman (spaceman)
15 Lady knife (cut) the flower
15 (The school bus goes to the circus.)
16 Man cut the flower
16 Spaceman witer (write) the Boat
16 (Tarzan grab the crayon box.)
16 Rabbit redI (ride) the Bicycle
16 Dragon go to Stars (steps)
16 (Superman kicks the ball.)
17 (The teacher comes in the door and turns on the light.)
17 Sam ride the Car
17 John go to Tree
17 Dog fall down the Steps
17 (the bird goes to the birdhouse.)
17 Clown jump over the fire
18 Teacher three (draw) the Batman
18 (The woman goes to bed.)
18 Man look under the bed look under the Seok (sock)
18 Lady ride the Car
18 John get out the house has a Garbetcan (garbage can)
18 (A wrench and two hammers are in the tool box.)
19 Sam cut the tree and Hammer
19 Lady cook the Hamburgers
19 (John and Teacher wash the car.)
19 Batman catch the Ball
19 Lady turn on the light
19 (the indian rides in the boat.)
23 John cut the flower
23 Lady cook the Hamburger
23 (The helicopter comes down on the school.)
23 Tarzan cut the lion and Knife

October 1973

21 Horse kick the Teacher
23 (The snake comes out of the dog house.)

24 Lady turn on the Ligld
24 Sam cook the Hotdog
24 (Three men wash the car.)
24 (Teacher and John cut the flowers.)
24
24 Monkey has a Tanzar (Tarzan)
24 Woman hunt (hurt) the Rma (arm)
25 (On the table are a hammer, a wrench, and a tool box.)

25 Batman catch the Ball
25 Man come to the Woman
25 Lady gives the horn to John
25 (Three men and two women.)
25 Tarzan go to Elephant
29 Man takes a Bath
29 (Mommy cook the hot dogs on the stove.)
29 Woman hint (hurt) the Rma (arm)
29 Lady kick the Teachet (teacher)
29 Cat on the Camper
29 (Hickory dickory dock. the mouse ran up the clock.)

30 John has a Ball
30 Tarzan and Dragon
30 (Sandy makes a cup of coffee.)
30 Sam ride the Car
30 (John gets the wrench from the tool box.)

30 Woman go to Spider

November 1973

1 Teacher add the -----(numbers)
1 Woman get out the Steps
1 (The tiger, lion, elephant, and chicken go to the boat.)

1 Indian teke (point) the Beetsumt (finger)
1 (John cuts the ple.)
1 Lady has a two Sanke (snake)
2 John add the Nombers (numbers)
2 (The Lady lay down on the couch.)
2 Man put the two boot On

November 1973

2 Lady cut the dragon and Knife
2 Clown blow the Horn
2 (The tiger and dog and elephant and chicken go to the boat.)

5 Sandy lay down the Crwluch (couch)
5 Teacher ride the horse drink the Coke
5 (John throw the ball over the house.)
5 Tanzar (tarzan) climb (climb) up the Tree
5 (A wrench and hammer and fork and saw on the table.)

5 Sam get out the camper has a gaebrge (garbage) Can
6 (John and David watch the movie.)
6 Lady come on the tarzan go to House
6 Snake look under the Car
6 Lady pairt (paint) the Bird
6 Sam break the Camper
6 (The teacher washes the table.)
7 Man come lady has a Watch
7 (Mommy cut the pizza for Sam.)
7 Man takl (talk) the Telephone
7 Baby blow the Candly (candle)
7 Cat Sleep
7 (Two boys watch the movie on t.v.)
8 Teacher cook the Hamburger
8 (John puts the boot on.)
8 Break the Rocket
8 Gril (girl) gives the pumpkin to Supaeman (superman)
8 (The man blow out the candle.)
8 Red bird eat the Corn
9 (John paints the paper.)
9 Tarzan climeb (climb) up the Tree
9 Woman ride the Airplane
9 (Sam and two men ride the boat.)
9 Woman has a Teacher
9 Mommy catch the Ball
12 (Teacher makes a pizza.)
12 Lady tmir (turn) on the Light
12 John gives the dollar to Box
12 Tree on the Truck
12 (John sits down to watch the t.v.)
12 Tanzar (tarzan) takes a Bath
13 (John draw six balls on the paper.)
13 Jim and teacher hirt (hurt) the Hand
13 Two snake get out and go to the Doghouse

November 1973

13 (John eats the pumpkin pie.)
13 Mommy catch the Ball
13 ----------('/darum/") witer (write) the Paper
14 (Sandy puts the hamburger on the table.)

14 Man steps the Spider
14 Man tunr (turn) on the Light
14 Monkey fall down the Ceabrgecan (garbage can)
14 Two snake get out the and go to the Doghouse
14 (John sleeps in the house.)
15 (Teacher steps on the snake.)
15 Lady talk the Telephone
15 Batman cut the pizza and Knife
15 Dragon break the Tree
15 John look under the Couch
15 (The Indian reads two books.)
16 Jim has a hern and teacher blow the Horn
16 Baby look under the Dirve-in
16 (Two men catch the rabblt.)
16 Sam look under the paint (peanut) and Truck
16 (The three women wash the car.)
16 Man gives the dollar and Firm (From) the Box
19 John pairt (paint) the Boat
19 (The boy plays the guitar.)
19 Lady hunt (hurt) the Arm
19 Teacher catch the Ball
19 Tarzan has a Tree
19 (The lady cuts the tree with a saw.)
20 Tarzan and lino (lion) fall down the Tree
20 Snake eat the Igg
20 (John gives a bath to the dog.)
20 (Sandy eats the ice cream and makes the pan cakes.)

20 Teacher fall down the Water
20 Dragon himle (grab) the Sapeeman (spaceman)
21 Snake on the Box
21 (The lady puts the butter on the bread.)

21 Lady turn on the Light
21 Tiger and lion throw the shrit (shirt) and take a Bath
21 Snake get out the bird House
21 (Two teachers ride the bicycles to the movie.)

26 Lady sit down the Bed

November 1973

26 (The dragon grabs the spaceman.)
26 Cat drink the 7 up
26 Woman klck the Lady
26 (Sam breaks the camper.)
26 Teacher ride the Motorcycle
27 Mommy and dog take a Bath
27 Sam watch the Colortv
27 (David goes to church.)
27 (Teacher is making the pizza.)
27 Jim fly the Keti (kite)
27 Tarzan and lady go to House
28 (Sam takes a bath in the camper.)
28 Tarzan run go to School
28 Woman open the Stove
28 Dog fly the Keti (kite)
28 Lady eat the Hotdog
28 (The cat is sleeping on the bed.)
29 Man has a Toy
29 Lady catch the Ball
29 (The fork is in the peanut butter jar.)
29 Sam tunr (turn) on the Pump
29 (The teacher lights the fire.)
29 Lady ride the horse and get the Baby
30 (Two men are eating in the truck.)
30 Woman and teacher run the Water
30 John wtier (write) the Paper
30 Lady and man on the Couch
30 Tarzan ridr (ride) the Lion
30 (Mommy hurts her hand on the car door.)

December 1973

3 (The Batman is kicking the dragon.)
3 Tarzan has a Lady
1 Lady cut the cheeze (cheese) and Knife
3 Woman ride the car teacher on the Car
3 (Mommy turns on the pump.)
3 Man Run
4 John sumor (dump) the Gearbargecan (garbage can)
4 (The man steps on the spider.)
4 Clown fall down the Bicycle
4 (John throws the ball at the tree.)
4 Lady eat the ice cream and man -- (with) me

December 1973

4 Paint fall Down
5 Clown fall down the Airplate (airplane)
5 (John is sleeping.)
5 Batman open the Door
5 Three blue flower orange flower
5 Woman ting (bang) the Dram (drum)
5 (Sam is going to the drive-in movie.)
6 Man watch the Colortv.
6 Teacher kick the Dragon
6 (John is going to the store to work.)
6 Lady and woman ride the Car
6 (Tarzan runs to the house, but the elephant comes out the door.)
6 Indian fall down the Horse
7 (The mouse is running up the clock.)
7 Teacher throw the knife on the Tree
7 Lady read the Paper
7 Tree on the Truck
7 (Hey diddle, diddle,
the cat with a fiddle;
the cow jumped over the moon.)
7 John look under the Box
10 (The boy puts the ball on the table.)
10 (The boy puts the ball under the table.)
10 Ball look under the table and ball on the Table
10 Batman put the watch On
10 Superman hsit (wash) the Elephent (elephant)
10 Snake eat the Snake
11 Teacher thru (turn) on the Light
11 (John is going to sleep.)
11 Lady steps the Sunglasses
11 Man has a penny and two Dime
11 Superman has a Dragon
11 (The woman is going to the store.)
12 (The knife is in the pie pan.)
12 Jim steps the Banana
12 Ping (pink) Flower and pumple (purple) Butterfly
12 Man and lioman (old man) come witr (with) me get out the Church
12 Lady ride the Tractor
12 (John and Jim fly the kites.)
13 Oliman (old man) get out the Church
13 Man come wtre (with) me Lady

December 1973

13 Man come wtre (with) Me
13 John and jim fly the Kite
13 (Miss Lord jumps in to the water.)
13 ----------(Hickory dickory dock) the mouse -- (ran) up the clock
14 Lady come wtir (with) me two Dog
14 Oldman drink the Boof (beer)
14 ----------(Hey diddle diddle) the cat ---- (with the fiddle) and the cow jump over the moon
14 (Mommy opens the store to get the chicken.)
14 John fly the kite and jim fly the Kite
14 (Mommy and Sam and David and John are going in the camper to Walt Disney World.)